

Spatial Interpretation of Housing

~~The Role of Topological Intuition in the Evolution of the Houses in Seoul~~

by

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**Ph.D. Thesis submitted for the degree of
Doctor of Philosophy
in Architecture**

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ABSTRACT

An attempt is made to investigate the housing culture in Seoul to answer the question: how do old spatial values interact with a new domestic setting? The argument of this research relates cultural interpretation of housing to plan morphology, and demonstrates how social values and domestic space are interrelated and how their interactions have driven the evolution of housing through the twentieth century.

For hundreds of years, the housing form and culture in Seoul have been in consistency with minor changes. After the Korean War (1950-1953), however, a fast and fundamental change was started. A huge ^{number} amount of houses were constructed with a modern design concept which is completely different from that of the traditional courtyard house.

The first part of the analysis focuses on the diachronic process where the traditional courtyard house, which used to be a single dwelling prototype for centuries, is transformed ^{into} to modern houses. Using space syntax methods, it is shown how old activities are re-accommodated and their symbolic meanings re-negotiated in the modern setting.

The second part of the analysis focuses on modern apartment houses that became the most dominant dwelling type in the city from the 70s on. A new graph theoretic method is proposed to facilitate the mathematical exploration of sample plans, and it is revealed that the old topological relations of space still operate within the formal constraints of the apartment houses.

Synthesising these analyses, it is evaluated that what appears on the surface to be a radical change preserves at a deeper level the genotypical values of space that generate a gradual and continuous evolution. The old and new houses in Seoul are, therefore, separate only at the physical level, not at the spatial level.

distinct?

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Chapter 1

Introduction: research questions and problem definition

1.1 Aims and motives

1.2 Housing evolution: changing characteristics of domestic space in time

1.3 Changing housing culture in Seoul

1.4 The questions of research: the problem definition

1.5 From the pre-requisites of the research towards a research methodology

1.6 Structure of the argument and the layout of the thesis

1.1 Aims and motives

This study examines the modern houses in Seoul constructed in the twentieth century to show how an old concept of living could have been instilled into a new domestic setting. The house reflects the values and needs of the people in a given society. In a natural progress of housing evolution, it tends to follow changing needs of the people; but in an unusual case, a new type of house is introduced by a small number of planners with an expectation to change the living style of the people. The modern houses developed in Seoul from the middle of the twentieth century can be a good example of this unusual case.

For hundreds of years, until the earlier period of the twentieth century, the housing form and culture in Seoul have been in consistency with minor changes. After the Korean War (1950-1953), however, a fast and fundamental change was started. During the second half of the century, where the wholesale reconstruction of the country was backed up by rapid economic growth, a huge amount of housing was constructed and that completely with an unprecedented modernist design concept – thus cutting off the hundreds of years' consistency in dwelling style. The modern type of housing that has been evolved in the west was suddenly transplanted to this Far Eastern region without much consideration. This radical change, consequently, has imposed great pressure upon the builders and dwellers; they had to adapt themselves to the new type of modern dwelling that was not tested and evaluated before.

In the hidden side of this change, old spatial values started to operate in two ways. For the designers who were full of energy to renovate and thus enhance what they believed to be an outdated housing culture, these values were not something to be openly advocated; but at the unconscious level, their picture of the new house was deeply rooted in the image of the old house in which they grew up. For the dwellers who still carried the old domestic behaviour, the new house was, first, interpreted as a re-arrangement of the old house; they tried to map each of the old spaces to a new one. In this process, some of the new spaces were re-interpreted against the designers' will, and sometimes in extreme cases, the inhabitants tried to modify the structure of the house.

Dealing with this unusual process of housing evolution in Seoul, the whole argument of this thesis has been designed to answer the question: *how do old spatial values interact with a new domestic setting?*

1.2 Housing evolution: changing characteristics of domestic space in time

Environment implies what surrounds us; it can both allow and constrain our behaviour and thus in the long run, it imposes conditions that regulate and affect the way we live. When its properties are changed in time, it provides, perceptually and behaviourally, different spatial exploration to us. Environment can change us but at the same time it can be changed by us. Amongst all sorts of environment, what can be actively designed and modified by human beings is the architectural environment.

Formal change in architectural environment reflects social change; what is ordered and arranged in space by human intention mirrors social minds of the time. The architectural environment, in return, regulates and orders human lives, and thus re-generates implicitly the cultural norms of the society. Therefore, Hillier and Hanson (1984) denied the conventional view of the man-environment paradigm as it only sees the two as a static cause and effect relation. They contended that because, in this paradigm, the physical environment has no social content and society has no spatial content, it does not represent the real world where social implications are embedded in the spatial configuration and interact with human agents. In this study, following this line of thought, architectural space is interpreted as an important source in which the social minds of the makers are preserved and then interpreted by the users of the space as if reading a text or rather a book. Further discussion on this issue comes in the next chapter, when the related literature is reviewed.

This thesis tries to illuminate the changing domestic culture in housing. Containing small-scale social activities that are particular to a cultural setting, housing has served as a best and solid manifestation of a society that suggests many viewpoints from which its culture can be interpreted. People change, their home-lives change and so do their houses. In some societies, these changes occur slowly but in others very rapidly. Historically, the twentieth century was the time these changes were made at an

unprecedented speed and, geographically, Seoul, the capital city of South Korea, can be regarded as having experienced one of the most radical changes. Thus, R. Meier, already in 1970, pointed out that “nowhere else in the world today are the processes of urbanisation so intense, so compressed in time, as in the capital of South Korea” (Meier 1970, 382). For this city, the advent of the modern western style living has enforced a fundamental modification in living style, and this whole change was made with the highest intensity in less than a half century owing to its explosive growth of economy and population after the devastating demolition of the city during the Korean War (1950-1953). Figure 1.1 shows how the population of the city has grown in the 20th century at an unparalleled speed compared with other major cities in the world.

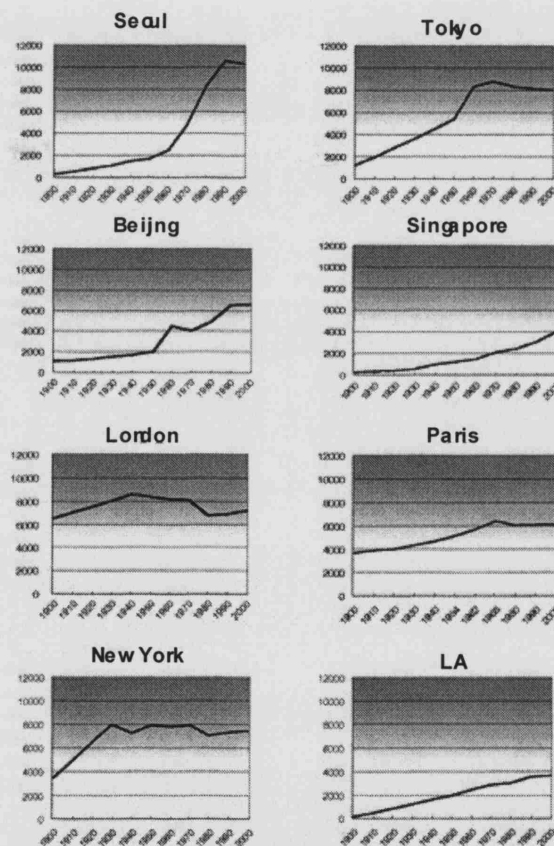


Figure 1.1 Population growth of major cities in the world (Seoul Development Institute 2002)

The changing nature of domestic space in time is regarded as an evolutionary process in this study. The most important point in this conceptualisation is that it is not the house as a thing alone from which the evolution is measured; it is the capability of a given society as a whole in generating houses that evolves. Obviously, it would bring about an untidy

chronological classification of forms if only the phenomenological features of building forms, not the ability of the designers, ^{were} are taken into account. In any city in the world, one can easily find old-fashioned houses that are still remaining, and also sometimes being built even at the present time. This does not, however, mean that the society is still relying on its old design capability. On the contrary, the design capability of the society as a whole is constantly moving on to the next evolutionary stage, and the old style remains in their accumulated design knowledge as a reference which can be sometimes used when needed. This point is well elaborated by Glassie in his book, 'Folk Housing in Middle Virginia' (1975):

"It is impossible to describe change in terms of things. It is not culture's discrete behavioural or material manifestations that change; what changes is the ideas that are culture. What changes is not the individual products of the competence, but the rules in the competence. ... Houses, of course, do not "evolve"; what evolves is the ability to design houses." (Glassie 1975, 111)

Thus Steadman in his book "the evolution of designs" also points out that it is "abstract designs" that are transmitted through evolution just as the "genotype" in biology as against "phenotype":

"It is not individual artefacts which evolve. It is abstract *designs*, of which particular artefacts are concrete realisations. The distinction corresponds to that made in biology, considerably after Darwin, between the *genotype*, which is the 'description' of the species transmitted through biological heredity, and the *phenotype*, which is the physical embodiment of what is described in the individual organic body." (Steadman 1979, 81).

This biological analogy of architecture is the linguistic and conceptual tool in this study from which the changing process is better understood. Steadman, further noted that the analogy of design to organism can be made in terms of the parts and the whole relation and is based on two distinct features, i.e. appearance and function. Since it is the spatial configuration of the house that is the point in focus in this study, its biological analogy to an organism would be the topological relation of functional parts rather than their formal appearance.

In many cases, housing evolution resembles the process of Darwinian evolution. It is a trial and error process where variations made by designers are selected by the users of those houses; just as in natural selection, only the design that is chosen tends to survive and prosper. In the pre-industrialised world, as in Seoul until the early 20th century, this trial and error process occurred very slowly and housing design followed tradition by

simply copying the existing pattern with minor variations – thus making a steady heredity line of housing style. In the industrialised modern world, in contrast, many variations are made and therefore the trial and error process is going very fast; new materials and construction methods as well as new design styles are introduced to encourage designers to make more trials and therefore to risk more errors. In an extreme case, such as the modern housing construction in Seoul after the Korean War, many new types of housing are designed by a small number of planners in a short period of time – thus making the Darwinian evolution process extremely fast.

There is, however, one aspect in housing evolution that does not conform to the Darwinian analogy. In Darwinian evolution, variations are created randomly without purpose or meaning but in housing evolution, they are created with designers' intention – thus they have evolutionary direction in a Lamarckian sense as Steadman noted:

“Darwin's theory implied...that evolution was without direction, without any over-riding purpose or plan. The theory of Darwin, using Lederberg's terms, is an 'elective' theory, where the environment chooses appropriate changes in organisms from the range offered by variation. Lamarckism is an 'instructive' theory, where the environment is imagined to be able to exercise a direct effect on organisms, and to 'teach' them to change themselves in appropriate ways. It is the fact that cultural evolution is an 'instructive' process in an analogous sense which gives it its 'Lamarckian' characteristics.” (Steadman 1979, 187)

Despite the fact that there are some characteristics in cultural evolution that do not conform to biological evolution¹, this analogy is still useful in this research since it helps to capture the concept of the changing process of housing more effectively.

1.3 Changing housing culture in Seoul

In the beginning of the 20th century, Seoul was a small capital city of Korea unknown to the world. This city of 200 thousand population was located above the Han River and the central area was surrounded by a wall (figure 1.2). Although the city had been the capital city for more than 500 years at the time, the political and economic systems of the country were maintained without much change under the rule of the Chosun dynasty

¹ Steadman notes: “Furthermore, cultural evolution or change differs entirely from organic evolution – whether pictured according to the Lamarckian or the Darwinian theory – in the way in which the hereditary information is transmitted 'exo-somatically', outside the body; and by the fact that the storage of such information is *cumulative*.” (Steadman 1979, 188)

(1392-1910) and thus was not expecting the explosive growth for the rest of the century. This central place of the agricultural society started to change around 1900 when the country was forced to open its harbours by foreign forces including Japan, USA, China, and Great Britain.² The western culture, which had not been experienced before, started to gradually influence all the aspects of the society and thus the living environment was not the exception.

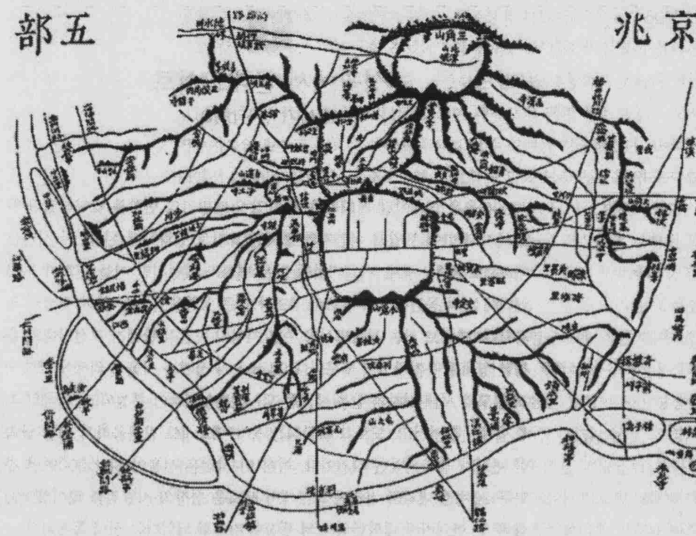


Figure 1.2 Old map of Seoul (Daedongyeojido 1861)

It was at this period that foreign settlements appeared within and around the city, the inter-city and intra-city railways were constructed, and the urban grid was renewed and expanded. At the same time, those western style buildings like schools and hospitals and train stations built in the city introduced a totally new architectural style and changed the existing concept of the built environment. Around this time, electricity and running water began to be provided in the city for the first time and this too has directly and powerfully influenced the domestic environment of the houses.

From 1910, when Korea was colonised by Japan, until the end of World War II in 1945, the city structure was planned and modified by the Japanese colonial government and more Japanese settlements were built in the city making the Japanese house style more

² One important index that shows the foreign influence at this time is the increase in population in the city. In 1900, it was 196,898 but in 1910, after a decade, it grew up to 238,488. This increase was mainly due to the foreign settlers (34,000 in number) including Japanese, Chinese, and others (Lee 2001, 33).

familiar to the public. In the meantime, the number of citizens kept growing to reach 400 thousand in 1935 and 1 million in 1942.

A growing number of foreign houses were built in the city during this colonisation period; they were mainly Japanese houses and a comparatively small number of western style houses. Built mainly by Japanese builders and western builders in their own style, these houses could hardly be the prototype from which the traditional housing style in Seoul was deeply affected. Some high-class houses adopted some features of them, but they did not have a critical impact on the housing culture in general. On the contrary, the Japanese gradually adopted Korean housing features including *ondol*, the traditional floor heating system, in their houses to adapt to the Korean climate. Korean people, by and large, preferred the traditional courtyard house and therefore it can be said that the real massive change in housing style starts from the middle of the 20th century when the mass development of the modern houses began (see Son 2001, 234).

One noticeable change in housing style in this colonial period is the development of the urban traditional house. It was a simplified type of traditional courtyard house developed by the private sector Korean builders to fit to small urban plots and was usually built in multiple numbers from 6 to 7 and sometimes 30 to 40 (Son, *ibid*, 241). From the 1930s to 1960s, the urgent demand for houses by the middle class families was successfully alleviated by this compact type of urban housing that still preserves the same spatial layout as the old houses in the city. It was sometimes called the 'modified traditional house' because it used new materials like bricks, glasses, and galvanised iron.

In 1941, the colonial government set up the '*Joseon Jutae Yeoungdan*' (*Chosun housing institute*) for housing development. It was the government's first action to cope with the increasing deficiency of housing in the major cities. Their initial plan was to build 20 thousand homes in four years (5 thousand per year) but they ended up building 12,184 homes countrywide including 4,488 in Seoul until the colonial regime's collapse due to the defeat in the War in 1945. The colonial house has meaning, in that it was the first generation of the modern house with a self-contained rectangular shape that enclosed a bathroom. This house, however, was not accepted as a favourable modern housing prototype because it intentionally adopted too many unfamiliar Japanese features with a view to assimilate Korean people to Japanese culture.

While the colonial house could not have much impact on the general public due to its limited quantity and heterogeneous style, it is assumed in this thesis that at least the layout pattern of the house, i.e. the two-row layout of rooms linked by a central corridor, has influenced Korean builders and planners. For them, it must have been thought of as an attractive suggestion for the new house they were about to plan in the following decades.

After Korea was liberated from the Japanese regime in 1945, soon there was a Korean War (1950-53) dividing the country at the centre of the peninsula. Even though the Japanese dwellers in the city went back to their country, the population of the city was still growing fast. Those Korean people who escaped the colonised country awhile and the refugees from the communist regime in the north were returning, accelerating the speed of urbanisation. By the middle of the 50s, the population was already reaching towards 2 million.

From 1955, as ^{the} housing deficiency became the most serious social issue, many public institutes, finance corporations and charity organisations as well as the government started to participate in housing supply in the public sector. The major source for funding was from UNKRA (United Nations Korean Reconstruction Agency) while minor funds were ^{provided} by the government and other organisations. The public-sector detached houses built by these parties were named in many different ways³, but were generally called ‘*gongyeung jutaek*’, which literally means ‘prosperity housing’. By the end of 1961, the total number of public housing⁴ built in Seoul amounted to 17,137 of which the ICA houses funded by the Korea Industrial Bank were 6,487 and *buheung* houses built by the Korea National Housing Corporation were 1,372 (Seoul metropolitan government, 1998). According to the national statistics in 1960, there were only 260,399 houses in Seoul including the public housing, while there were already 447,089 households – 41.8% of housing deficiency rate. This means that more than 180 thousand households were living in rented rooms without their own houses. Therefore, the supply rate of the public housing in this period could not meet the increasing demand.

³ These housing names include: Buheung jutaek (prosperity house), Jaegun jutaek (reconstruction house), Dosi hyung jutaek (city type house), Nanmin jutaek (refugee house), Jajo jutaek (self-helping house), Sijeol jutaek, Gungmin jutaek (people’s house), Gani jutaek (handy house), ICA house, Huimang jutaek (hope house), Gaeryang jutaek (improvement house), etc. (Son 2001, 308)

The public housing built in the 50s has an important meaning in the history of housing development in Seoul. Although its quantity was far below the growing housing demand in the city, it suggested a new prototype for the modern house with its westernised spatial layout and thus affected and facilitated the subsequent housing development in the private sector. In addition, as the houses were mainly planned in the outskirts or unused parts of the city, the infrastructure could be expanded to allow more residential areas to be developed nearby.

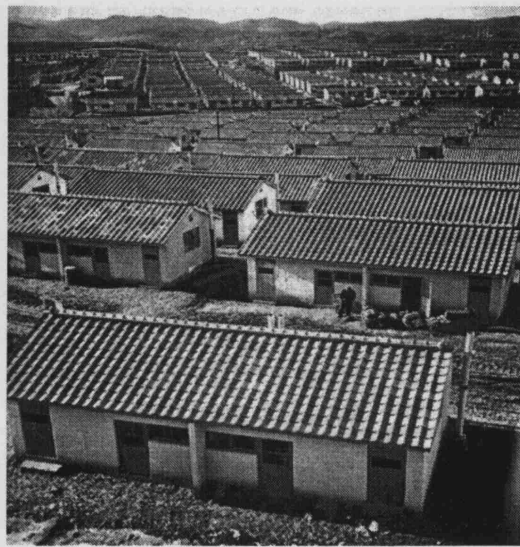


Figure 1.3 Guro residential district (1961) (from Son 2001, 261)

The first generation of mass development of public housing – a total of 875 houses were built.

It was from the 60s that the systematic development of housing was started; compared to those in the 50s, bigger scale constructions covering broad areas were executed based on the government's urban land use program. Two different types of housing development should be noted in this period. First, more actively, KNHC initiated mass developments of housing (figure 1.3). For example, they built 30 thousand homes in Hwagok area and 60 thousand in Gaebong area, each as a single residential district respectively. Second, from the middle of the 60s, the government began to think that it is ideal to build apartment houses in the city rather than detached houses to meet the growing housing demand. While there were no qualified developers and builders in the private sector who could build this new type of housing, the government and KNHC planned Mapo apartment houses in 1962 as a first scheme in the country that is based on a site planning concept with multiple numbers of building blocks (figure 1.4).

From the 70s on, the apartment housing gradually became the most popular dwelling type in the city. Successfully, this housing type has made a primary contribution in supporting what has become a city of 10 million people. In the year 2000, there were already more than one million apartment units in the city accommodating more than a third of the citizens.

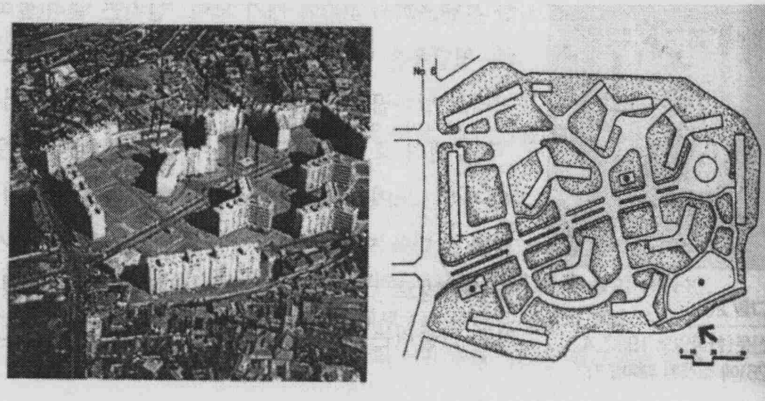


Figure 1.4 Mapo apartment houses (1962), the first scheme with a site-planning concept

On the other side of this success, however, criticisms come that it has created a monotonous living environment. The thin slab shape of the building, which is regarded as a best choice for highest density, became the typical form of the housing all around the city and, one by one, residential areas turned to a town filled with the stereotyped concrete buildings without identity. Moreover, since this typical building shape has necessarily imposed similar unit layout patterns, it took away the chance for the customized design for different groups of people.

Apart from its evaluation for its success or failure, it is true that the apartment house in Seoul has been accepted as a most preferred type of dwelling and the spatial layout of the plan effectively sustains the normal lifestyle of the citizen. Through test and trial in the 60s and the 70s, a small number of typical plans have been selected and have become ubiquitous throughout the city. Therefore, in a broad sense, it can be said that the domestic life at home in Seoul is rather homogeneous even in this post-modern world where all kinds of different values for life are coexisting. It can even be generalised that if the ordinary home life in Seoul was moulded by the typical traditional courtyard house

until the middle of the twentieth century, now it is the typical apartment house that takes this formative role.

1.4 The questions of research: the problem definition

This thesis examines the changing housing culture in Seoul with a question: *how do old spatial values interact with a new domestic setting?* This general question can be more effectively answered by splitting it into three specific sub-questions: first, *how is an old spatial organisation mapped onto a new setting that is formally and functionally different?*; second, *how is an old conceptual dimension in space transferred through a transformation process?*; third, *how is the spatial intuition from the past accommodated within the formal constraints of modern housing?*

In the previous section, it was described that the change of housing style in the city was initiated by a small number of planners in a short period of time after the Korean War. For the planners, the reconstruction of the city after the demolition from the War was regarded as a good opportunity to change and enhance the old housing culture. Since many housing developments were assisted by foreign aid, including funds and manpower mainly from the USA, these planners could have a proper chance, for the first time, to learn western style housing. Efforts were made to generate new housing plans, combining their real experience of the existing housing types, i.e. the traditional courtyard house and the colonial house, and their indirect experience from the imported architectural references to modern housing. It is this particular setting that caused the highest degree of change in the middle of the twentieth century in Seoul within the long process of housing evolution in the city. In other words, it was the point in time where the old and new values collide most fiercely. Even though the majority of the houses in the city were still remaining as before in their traditional forms, builders' and designers' 'architectural competence' in Glassie's term was moving fast to the next phase of design evolution. Therefore, it was now the citizens' turn to change their concept of domestic space and adapt themselves to the new house that would soon be the standard type of dwelling. Both for the designers and the citizens, the new house with its unprecedented spatial layout was something that demands a change of thinking. Hence, the big question of this thesis comes: *how do old spatial values interact with a new domestic setting?*

In order to investigate the interaction of these two heterogeneous ideas, i.e. the old spatial values and the new domestic setting, first, it is needed to translate the amorphous concept of ‘the old spatial values’ into a material entity – the old domestic setting. The next step is to compare these two to find out the clue that would explain how one is transmitted to the other. In this respect, the big question of the thesis can be more precisely modulated to become the first sub-question: how is an old spatial organisation mapped onto a new setting that is formally and functionally different?

When people move from one house to another, they have to adapt themselves to the new environment. It is not only their material belongings that need to be redistributed into the new space; their living pattern which includes all kinds of everyday activities need to find proper ways to be accommodated in the new environment in such a way as to maintain the same or an adapted way of domestic living. If the old and new houses share the same design style and thus have similar spatial layouts, the job would be simple and straightforward; by mapping each functional space of the new house to that of the old one, materials and activities can be easily categorised in the same manner as they were in the old house. On the other hand, if the old and new houses do not share any style at all and thus have fundamentally different types of internal space arrangement, it is impossible to make a one-to-one mapping of functional spaces. In this case, inhabitants have to find a new way in which their materials and activities are decomposed and then redistributed, as happened in Seoul in the 50s and 60s. Based on this conceptual frame, the second sub-question above is answered in chapter 4 through an examination of the ‘space-activity’ interaction.

The house reflects the ideal of a given society. It is not a simple mechanical device where necessary functions are allocated practically into divided sections in the most efficient ways. Rather, it is a cultural manifestation where meanings and values of the time pervade. It is also a mythical place where all kinds of symbolic dimensions exist: male/female, divine/secular, non-polluted/polluted, inside/outside, etc. In this conceptual perspective, domestic space is not symmetrical; it is an integration of asymmetrically distributed spatial significances in which different symbolic qualities are co-present.

What is unique in Korean domestic culture is that it has a strict distinction between the raised and lowered level of the floor. The elevated floor, of which the original function was the cooling in summer and heating in winter, has been symbolised as a non-polluted divine part of the house that ought to be maintained extremely clean all the time. This symbolism was another 'old spatial value' that should find a proper way to be accommodated in the new domestic setting during the radical change of housing culture in Seoul. Thus, the second sub-question is asked to deal with this particular issue: how is an old conceptual dimension in space transferred through a transformation process?

In the early stage of the modern housing movement after the Korean War, some architects advocated that this old concept should be abandoned and replaced by a western one. It turned out ~~to be~~, however, that the symbolism not only survived the change but also has affected the direction of the housing evolution in Seoul. Questioning and answering about the evolutionary meaning of this 'level distinction' makes up the second half of chapter 4.

Passing through the short yet radical changing process during the middle of the 20th century, the apartment house became the fittest of all types of housing, dominating the housing market. In the year 2000, it already occupied 51% of the total housing stock in the city, but its portion is anticipated to get bigger since the share of this housing type amongst the total of the new housing construction in each year grows faster reaching stunning 90% in 1999. What is more interesting is that, amongst all types of unit plans, only a few have survived.

The typical building shape of apartment housing in Seoul takes a thin slab form and units are placed linearly in each floor. Staircases are used to give vertical access and, in each floor, a unit is entered directly from a staircase in the case of the staircase type, or via an exposed public balcony in the case of the balcony access type. Within this typical building structure, the unit plan is likely to become a rectangular format which is open to two opposite sides, and designers need to find a optimum solution in which the required rooms are best arranged within the rectangle. One thing that is extraordinary in this design process is that, amongst many possible choices, there appear only a few dominant standardised patterns preferred by the designers in Seoul. It is from this observation that the relationship between the old spatial intuition and the modern planning in Seoul is

investigated in chapter 5 with the third sub-question: *how is the spatial intuition from the past accommodated within the formal constraints of modern housing?* To answer this question, a new approach to graph theoretic analysis is suggested in order to effectively show the existence of the old spatial intuition strongly involved in the modern planning process.

1.5 From the pre-requisites of the research towards a research methodology

In the previous section, the aim and scope of this thesis have been more clearly outlined by defining the problems and modulating the research questions. The following question in this section is in what way those questions could be answered. What is needed is a proper theory and methodology that could synthesise all the variables to answer the questions of this research without conflict. There are several pre-requisites that the research method of this thesis should possess.

First of all, the methodology should have an explanatory power to describe architectural space in an analytical manner. As will be shown in chapter 2 devoted to literature review, there exist many different types of approaches that have tried to analyse architecture and its space – this includes Altman (1980), Lawrence (1990), and Rapoport (1990). They have suggested their own methodological models through which architectural research could be more systematically investigated and analysed. Their efforts, however, were not practical enough to be applied to architectural research in general; they were merely suggesting a list of possible factors that might help in analysing an architectural environment (Altman and Lawrence) or too abstract to be useful in real research (Rapoport). Hence, what is needed in this thesis is a methodology that is concrete enough for real-life adaptation and persuasive and logical enough for analytical description.

Second, the methodology should demonstrate an analytical objectivity in inspecting the culturally heterogeneous settings. Since this thesis deals with a chronological change in housing space that expands from the traditional type to the modern one, it would be a primary concern if these houses, formulated and lived in during different social systems and environments, were to require different sets of variables for analysis, as this would

spoil the coherence of any subsequent interpretation. What is required in this study is the ability to interpret the old and new houses in a single methodological framework.

Some outstanding examples of previous research have successfully tackled the issue of illuminating a transformation in housing. For example, Glassie (1975) displayed a highly analytical way of seeing the housing evolution based on Chomskian generative grammar, and Michael Ann Williams (1991) took an ethnographic approach to reveal the inhabitants' real perspective on architectural space and its change (see chapter 2 for details). The methodologies they used, however, are not useful for this research. In their case studies, sample houses were laid on a constant line of time where small changes in architectural language and social values were overlapping with the existing ones without any gaps, and therefore, the houses showed, in a broad sense, consistency in style. In order to explain two heterogeneous sets of houses that are formally and culturally somewhat different as in this thesis, another methodological approach is needed that is neutral and free from changing social variables in its pure state of analysis.

Third, there should be a convincing connection between the morphological analysis and social interpretation. Put differently, the application of the methodology should not be restricted to describing the physical and superficial features of the architecture; it should have a capability to be linked to a socio-cultural dimension. In the second requirement described above, it was emphasised that the methodology should possess the analytical objectivity that is free from changing variables in time. This does not, however, mean that it should not be connected to the level of cultural interpretation. At the methodological level, the morphological analysis is supposed to be independent without the interference of changing variables, but at the theoretical level, the analysis should become the groundwork that leads, in a logical way without arbitrariness, to a subsequent evaluation and interpretation.

In sum, what has been described above shows the three pre-requisites that any methodology appropriate to this thesis should possess: an analytical description of space, an analytical objectivity, and a systematic connection to a social interpretation. As will be discussed in more detail in the next chapter, there is only one theory that fits ~~to~~ these conditions. Space syntax theory exhibits the quality and methodology that is in demand in this thesis. About the rationale of this theory, Hillier and Hanson note:

"First, it must establish for space a descriptive autonomy, in the sense that spatial patterns must be described and analysed in their own terms prior to any assumption of a determinative subservience to other variables... Second, it must account for wide and fundamental variations in morphological type,... Third, it must account for basic differences in the ways in which space fits into the rest of the social system... This means that we need a theory that within its descriptive basis is able to describe not only systems with fundamental morphological divergencies, but also systems which vary from non-order to order, and from non-meaning to meaning." (Hillier and Hanson 1984, 5)

From their statement, it is evident that ~~the~~ space syntax theory ~~has been~~ originated with the purpose that is almost ^{aims that closely matches} matching with the methodological pre-requisites of this thesis described above. The space syntax method first acquires purely morphological information from the configuration of architectural space and represents it in an analytical way using graphs and mathematical values. Based on these topological indexes, then, interpretations follow to see what kind of social implications are embedded in the spatial structure.

1.6 Structure of the argument and the layout of the thesis

In the previous sections, the research questions that define the problems of this thesis were suggested and the proper methodology appropriate to the problems was chosen. The theoretical framework of the thesis can then be illustrated as in figure 1.5 below.

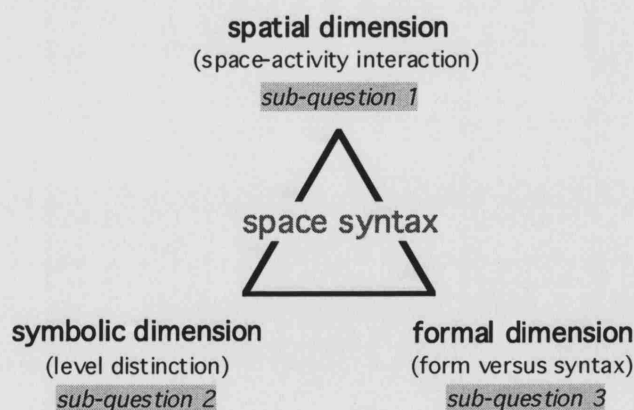


Figure 1.5 The theoretical framework of the thesis

The theoretical structure of the thesis is constructed based on the theory and methodology of space syntax. The whole argument of the thesis is divided into three categories: a spatial dimension, a symbolic dimension, and a formal dimension. Within

the category of the spatial dimension, the housing evolution in Seoul is examined in terms of spatial configuration, and this will answer the first sub-question: *how is an old spatial organisation mapped onto a new setting that is formally and functionally different?* The key concept in this part of the argument is the ‘space-activity interaction’.

The second category is characterised as a symbolic dimension. Focusing on the symbolic concept of ‘level distinction’ which underlies the process of housing evolution, the second sub-question is answered: *how is an old conceptual dimension in space transferred through a transformation process?*

Lastly, the third category of the argument is defined as a formal dimension. What is highlighted in this part of the thesis is the inter-relationship between the formal compositional structure of the housing and the syntactic configurational structure of its space – ‘form versus syntax’. This category will answer the third sub-question: *how is the spatial intuition from the past accommodated within the formal constraints of modern housing?*

Chapter one has described what the whole argument of the thesis is aiming for. In the beginning, it was shown that the changing housing culture in time could be understood as an evolutionary process. This analogy was then adapted to the unique case of Seoul where the change was fast and intense. Reviewing the brief history of changing housing culture in Seoul, research questions, which would help define the direction of the study, were asked and then based on the pre-requisites of the research, a methodological framework was suggested.

Chapter two reviews related literature and methodologies that deal with the morphology of housing. Starting from the conceptualisation of the house as a text which can be encoded and decoded by designers and users, the chapter carefully evaluates the literature to see how the abstract meaning of housing culture can be studied. Through this investigation, a proper research framework is constructed in detail, and at the end the rationale behind the selection of the main theory for the thesis, space syntax, is elaborated.

Chapter three concentrates on the history and general characteristics of the houses in Seoul. This chapter first provides information on the early origin and evolution of Korean domestic space with its cultural and environmental causes. Next, the historical background and the morphological traits of the four housing types that existed in the twentieth century – the traditional courtyard house, the colonial house, the public sector detached house, and the apartment house – are described in detail in chronological order to provide knowledge required to understand the two following analysis chapters.

Chapter four is designed to answer the first and second sub-questions of this thesis which have been described in chapter one. Using the space syntax technique, the chronological change of the housing space in the city, ranging from the traditional courtyard house to the modern apartment houses, is investigated. The findings from the analysis strongly suggest that under the radical formal change on the surface, there is a gradual evolution of old spatial values.

Chapter five focuses on the modern apartment houses. In this chapter, the main concern moves towards the inter-relationship between the housing form and its spatial layout. A new graph-theoretical representation is suggested and utilised to generate an insightful dissection of the modern design trend, and further its hidden connection to the old spatial intuition is illuminated.

Chapter six synthesises and concludes the whole argument. Here, those three categories of research in different dimensions illustrated above are put together. By revisiting the analyses in chapters four and five, it is discussed how those findings could be connected and understood within the global perspective of the thesis to answer the main question: *how do old spatial values interact with a new domestic setting?* At the end, the contributions and limitations of the study within the field of architectural research are discussed.

Chapter 2

Housing and Space: literature review and methodologies

2.1 Introduction

2.2 The problem of domestic space and its association with social meaning

2.3 Change of housing culture seen through formal transformations

2.4 Design mechanism and grammar

2.5 Floor plan morphology and graph theory

2.6 Space syntax: theoretic statement and critical evaluation

2.7 Summary and discussion

2.1 Introduction

In this chapter, following the problem definition and research questions described in chapter 1, related literature is reviewed to contextualise the research. What is intended in this chapter is to prepare a preliminary narrative of the theoretical structure of the thesis, and therefore the academic breadth and depth of the literature on architectural space in general are not given much consideration. In this regards, this chapter becomes a complement to the research proposal declared in chapter 1 by providing a methodological foundation on which the main bodies of analysis in chapters 4 and 5 are established.

This chapter is divided into five major sections. The first section raises a fundamental question: how can housing research be successfully linked to socio-cultural interpretation? In this section, the problem of multiple meanings of housing is discussed and several studies that suggest research frameworks for housing are introduced, evaluated and criticised. In the second section, two exemplary studies dealing with the changing housing culture through time are compared and their methodological relevance for this thesis, where diachronic as well as synchronic analysis is necessary, is examined. The third and fourth sections focus on the formal aspects of housing, and the possibilities of illuminating a social dimension in the light of morphological analyses are explored by introducing the studies of design grammar and graph theory. The fifth section is dedicated to a review of space syntax theory. A theoretical statement of the theory and a justification for its role in connecting architecture to social interpretation are described.

2.2 The problem of domestic space and its association with social meaning

No building could possess as many layers of meaning as the house. As the most essential spatial setting for human beings, the house supports all aspects of everyday domestic routines and changing needs at different stages of life. The variety of words that can be associated with it, e.g. home, dwelling, shelter, habitation, and so forth, may reflect different angles through which it can be seen. In this connection, though being deceptive with its scale and character, when its function and meaning are considered, the house is thought to be the most complex building of all (Hanson 1998, 2). The study of housing,

therefore, becomes a subject that cannot stand alone without theoretically being exposed to other disciplines, and defining a proper research method becomes a critical concern for scholars in the field.

The most direct and basic approach to the study of housing is the typological interpretation in which the house is seen simply as the result of environment and technology; the meaning of the house, in this case, is degraded to its explicit day-to-day function. In this approach, houses are defined and classified by their formal types, building materials, techniques, decorations, and so forth and emphasis is put on the explanation of geographical variations. Classic examples of this are found in the works of Rudofsky (1964), Brunskill (1981), and many others dealing with contemporary and vernacular houses. In the case of the houses in Seoul, which comprise the sample of this thesis, there is a plethora of research on their typological aspects but a dearth of insightful research on their spatial meaning. Although such an approach is important as a first step where data is modulated in order to offer a good overview, a criticism always follows that it ignores the aspect of meaning.

The meaning of architecture is the most intractable issue that escapes clear understanding; it can be interpreted from many different perspectives and no single perspective can claim to be complete. It seems natural, therefore, that there exist only a few theoretical models that specify the variables or suggest the methods needed to investigate the meaning of housing. Altman (1980, 155-6) suggests, from the perspective of environmental psychology, three categories of factors that affect the formation of the house, i.e. environmental factors, technological factors, and cultural factors. He points out that it is impossible to identify the exact contributions of these factors, and unless those factors are viewed simultaneously, the analysis is incomplete.

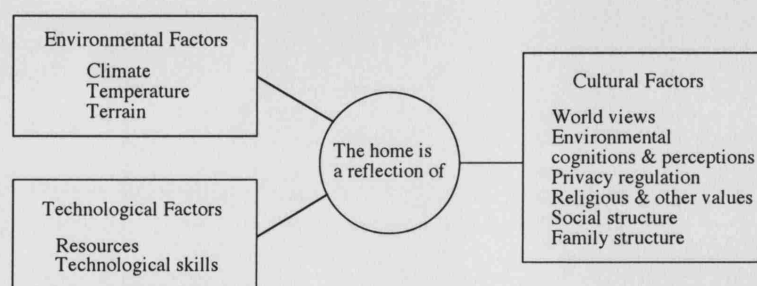


Figure 2.1 The home in relation to other factors (Altman 1980, 156)

His proposal seems more dynamic compared to the typological approach discussed above in that it includes a cultural dimension in addition to the environmental and technological dimensions. Admittedly, however, it is merely a suggestion of would-be affecting factors divided into three categories; it seems impossible to directly apply this model to real research. In addition, a closer inspection on cultural factors reveals that they overlook the day-to-day human practice and as a result the home becomes a static concept. In other words, the model excludes those social factors related to space usage, such as 'everyday domestic activities', 'interactions between the residents and visitors', and so on, which are decisive clues to link material structure to everyday practice. This is a similar type of criticism that can be applied to a structuralist interpretation of housing (Hodder 1982, 1986), and a detailed account on this issue will be introduced in the next section.

the
As above criticism indicates, in order to deal with the cultural dimension of housing, it is essential to examine the lively association of human bodies with material culture. Indeed, it is the movement of our bodies within domestic settings that enables the learning and practicing of a particular culture imprinted in the spatial configuration. Thus Stea notes:

"Everywhere, people eat, clean their bodies, and launder garments, in culturally ritualized ways. Their activities in the domestic sphere inevitably involve age- and sex -role differentiation, as well. Thus, the domestic environment not only communicates and is communicated with, but it acts as a setting for the transfer of knowledge and cultural values. In this way, the built environment serves as a setting for people-to-people communication, once again" (Stea 1987, p.xiii).

One important characteristic in this 'communication' is that the process is performed without conscious effort; naturally, from the earliest stage of life, one starts to widen the understanding of surrounding environment by gradually being acquainted with his home (see Piaget, 1956). This could be understood as an 'act of incorporation' according to the psychologist Lang:

"Inhabiting is an act of incorporation; it is a situation of active, essential acquisition. Incorporation is the initiative of the active body, embracing and assimilating a certain sphere of foreign reality to its own body. In this sense, incorporation is essentially the movement from the strange to the familiar. This commerce of strange and familiar, which forms a central dialectic of human existence, is instituted and embodied in our

dwelling...This act of familiarization is performed as if by magic by active body. It is enacted at the most primitive level without the assistance of conscious thought.” (Lang 1985, p.202-203)

For the researchers dealing with the meaning of the house, this ‘familiarization’ means much more than simply getting to know the physical setting. By means of this unconscious process, a domestic setting that materialises the cultural norms of a society is experienced and remembered by heart. For the interpretation of a cultural dimension, therefore, the implications of a house as a medium to transfer the spatially imprinted culture should be explained. Across disciplines, this line of thought has affected scholars and provided a basic conceptual frame for the investigation of houses. It has been argued that the house is another type of cultural symbol that should be dealt with as if a text, where the message is encoded by writers and decoded by readers (Geertz 1973; Bourdieu 1977, 90; Moore 1986; Johnson 1993, viii; Blanton 1994). For example, Bourdieu adopts this analogy in his book, *Outline of a Theory of Practice*:

“The house, an *opus operandum*, lends itself as such to a deciphering, but only to a deciphering which does not forget that the “book” from which the children learn their vision of the world is read with the body, in and through the movements and displacements which make the space within which they are enacted as much as they are made by it.” (Bourdieu 1977, p. 90)

In this regards, it has been suggested that since a text contains a cultural message, the interpretation should be analogous to the ‘work of literary critics’ (Geertz 1973), and further, it has been also indicated that meaning can be reassigned by different groups (Moore 1986) or by different time periods (Johnson 1993). Obviously, discrepancies in the interpretation of meaning can arise from different research methods, different perspectives, and changed contexts. Bailey emphasise^s this complexity:

“The house therefore exists simultaneously within the dimensions of time, space, possession, wealth, protection, craftsmanship, access, permeability, weather patterns, technological ability, and so forth. Indeed it may prove impossible to exhaust the inventory of levels of perception. Each methodology, each society, and each individual will value the house differently by implementing different standards of measurement. Meanings of houses shift within temporal, spatial, and social parameters.” (Bailey 1990, 26)

The above arguments strongly suggest that research on housing cannot be successful by adapting a single approach; to acquire objectivity all possible approaches should be considered. Johnson (1993, 183), argues that in order to study houses that are ‘part of a

continually reinvented tradition', there needs to be 'more than a detached academic exercise' to secure the reliability of interpretation. A question, then, arises: how is it possible to systematically combine multiple perspectives in a single research? Concerning this question, Lawrence (1990) suggests a rigorous model. He first lists, based on his extensive survey on English and French literature, seven categories repeatedly used for the study of vernacular houses in the previous hundred years:

1. The aesthetic/formalist interpretation: concerned with the formal composition of buildings rather than what they mean and by whom and how they were used.
2. The typological approach: focusing upon the geometrical and compositional rules of extant house plans and the location of doors, windows and chimneys.
3. An evolutionary theory: concerned with the development and change in house plans and elements through time.
4. Social geographical diffusionism: relating the development of vernacular houses to the influence of social or geographical diffusion.
5. Physical explanations, such as materials and technology, site and climate
6. Social explanations, including economics, household structure and defence
7. Cultural factors including collective spatial images and religious practices

Pointing out the problem that these approaches have not been used in a complementary way by authors in diverse disciplines, he draws on Geertz' (1973) idea of 'cutting the culture concept down to size' and suggests that by defining and relating the context-dependent parameters, a built environment could be properly analysed and comprehended. At the end of his argument, Lawrence presents a conceptual reference model where each of three sets of parameters, i.e. physical factors, societal factors, and individual factors, represents one of the three dimensions of a cube (figure 2.2). He claims that if not in a specific context, these three sides should have equal weighting and lengths.

While Lawrence's research model seems to conform to the previous arguments that housing research should be grounded on a multiple approach, it still lacks a method for how these could be put together. For example, even though he provides as an example his own research, 'colonial houses and domestic life in South Australia' (ibid, 227), it is doubtful that he uses all the factors – and that in equal 'weighting'! – and takes into account their 'reciprocal relations' as advocated by himself. His model seems to have

strengthened the human or individual factors that are deficient in Altman's, but it still looks more like a suggestion of a checklist, rather than a well-defined method.

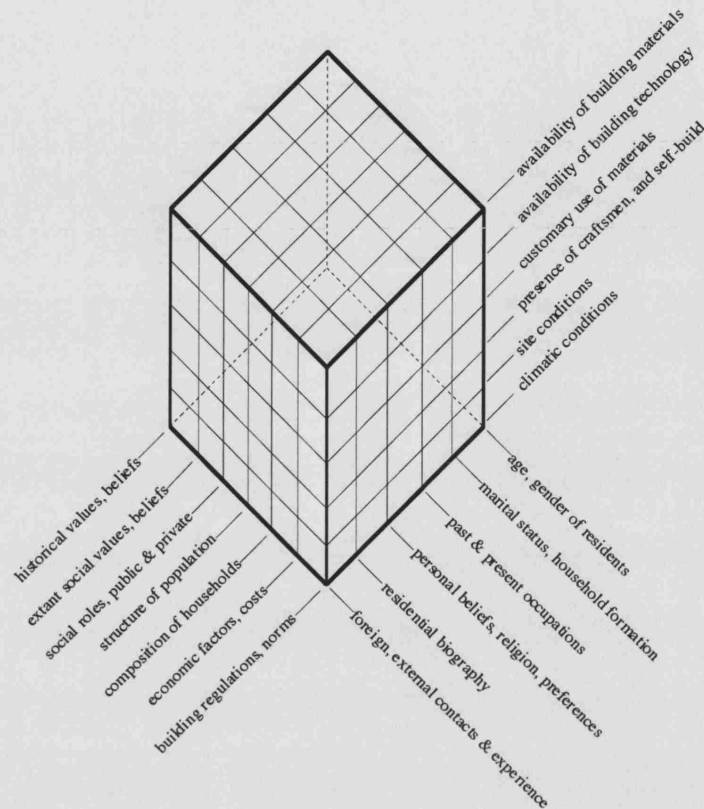


Figure 2.2 The conceptual model of vernacular houses, which considers the reciprocal relations between physical/material factors, social and cultural variables, and individual/human factors (reproduced from Lawrence 1990, 256)

Rapoport (1990) makes another type of suggestion. In his article, 'Systems of activities and systems of settings', he suggests, in a more practical manner than the previous models, how culture can be related to the built environment. In the beginning, he notes that 'culture' and 'built form' are different in scale, in that the former is a vast domain in which the latter is a subset, and the fact that 'culture' is 'too broad and too global' a concept makes research into houses difficult. From this problem definition, he suggests a sequence where 'culture', the highest level of abstraction, is gradually linked to lower level components to arrive at activities at the end. Through this process, the concept of culture is dismantled and becomes more concrete and manageable (figure 2.3).

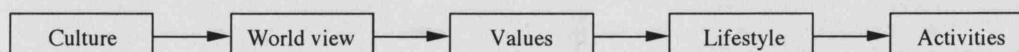


Figure 2.3 process of dismantling the concept of culture (reproduced from Rapoport 1976, 1990)

According to Rapoport, activities can be seen at four different levels: (1) the activity itself, (2) how it is carried out, (3) how it is associated with other activities and combined into activity systems, and (4) the meaning of the activity. As one goes down from (1) to (4), the level of culture goes up and finally reaches the meaning. To investigate the abstract notion of culture, therefore, one must see not single activities but a sequence of activities, i.e. 'systems of activities', as a whole. Rapoport then points out that activities and 'settings' are connected by 'meaning':

"The situation, the rules, and the ongoing and appropriate behavior are communicated by cues in the setting. This suggests that activities and settings are linked through meaning, in other words that the principal mechanism that links an activity and a setting is *meaning*" (Rapoport 1990, 12).

The concept of 'settings' was then further detailed: activities occur not in single buildings but in a variety of spaces including the outdoor environment, and at the same time, activities are affected not only by 'fixed-feature elements' (architecture), but also by 'semi-fixed-feature elements' such as furniture. All these ideas lead him to the conclusion that through the investigation of the mechanism between 'systems of activities' and 'systems of settings' the cultural meaning, which mediates these two, can be revealed.

In general, the conceptual frame suggested by Rapoport seems more suggestive and inspiring. Whereas those two models suggested by Altman and Lawrence are somewhat static and functionalistic in their nature, his model is more dynamic and oriented more specifically towards the link between culture and built environment. Rather than presenting a list of candidate factors that might have significance in the analysis of an artefact, this model shows how an abstract concept, 'culture', can be decomposed and become more specific.

While his model helps define the relation between culture and housing, and thus can be a good conceptual guide for research, there are some aspects that hinder this from being practical. First, it does not provide an actual method to investigate activities; it emphasises the utility of activities as a vehicle to understand culture but what it shows is their diversity which is hardly observable:

“the differential sequencing of activities in time as well as in space, tempos (number of activities per unit time) and rhythms (the periodicity of activities related to different cycles: lifetime, annual, seasonal, profane time/sacred time, festivals, work-day vs. weekend, day and night, etc.)”. (Rapoport 1990, 15)

Second, the model renders the concept, ‘settings’, out of control; according to Rapoport’s idea, the demarcation of spatial boundary for the purpose of research would be impossible since activities happen in a series of settings; in other words, they should not be confined within a single building but stretch out towards ‘the whole cultural landscape’ (Rapoport 1990, 12). In sum, although conceptually persuasive, the model is too abstract in terms of methodology to be useful for the investigation of real house samples.

Then, what could be a proper method applicable to housing research? To answer this question, it is necessary to return to the idea of seeing the house as an analogy of text. Many scholars seem to share the notion that the house has multiple meanings and, therefore, through different angles, different interpretations could be formulated, but only a few could suggest a consistent and systematic theory and methodology that respond to this innate problem.

A text can be read and interpreted in a number of ways according to a reader’s personal impression or judgement, but what is unchanging is the organisation of the text as a syntactic structure. Likewise, careful investigation on what buildings reveal in their pure state can be a fundamental and solid testimony from which interpretations can be established. This line of thought has affected Hillier and Hanson (1984). Reviewing various types of research on architectural space, they emphasise that the meaning of space can be explained not by ‘simple external causes’ but within the ‘intrinsic material nature of the artefacts’:

“In spite of considerable divergences, these approaches all seem to sidestep the central problem of buildings in the sense that we have described it: they do not first conceptualise buildings as carrying social determination through their very form as objects”. (Hillier and Hanson 1984, 8)

This is the core statement that distinguishes their theory, ‘space syntax’, from others. Given the research questions and the problem definition of this thesis, Hillier and Hanson’s approach is considered to be the theory that can give answers to those

questions. Before the justification and theoretical account of space syntax theory in section 5, it is necessary to overview other related approaches that put an emphasis on morphology of housing. By critical analysis of these, a more suitable framework for this thesis can be constructed.

2.3 Change of housing culture seen through the formal transformation process

Although lacking holistic explanatory power, structural anthropology has opened up the possibility that the form of a house can be more than a physical structure. It certainly brought to academic discussion the issue of built form, which used to be relatively neglected in anthropology (Humphrey 1988, 16). A criticism comes, however, that structural anthropologists see architectural space ‘as a by-product of something else whose existence is anterior to that of space and determinative of it’ and construct their theory with a limited number of cases (Hillier and Hanson 1984, 5). Even in those influential structural studies, e.g. Levi-Strauss on the Bororo village (1963), Tambiah on the Thai house (1969), and Bourdieu on the Berber house (1973), houses were simply thought of as reflecting a ‘symbolism or cosmology rather than as a subject in their own right’ (Humphrey 1988, 16). More importantly, structuralism ignores the role of individuals who have a potential to construct social change within a given context. In other words, individuals are portrayed as being ‘subordinate to the organising mechanisms of the unconscious’ rather than ‘competent social actors’ and there exists no effort to understand how structural rules can be changed through time (Hodder 1982, 8).

While the structural way of thinking has greatly influenced many scholars, considering all these drawbacks, it is clear that structuralism as a grand theory is inadequate for research such as this thesis, where the emphasis is placed on morphological changes in housing over time in relation to everyday activities. In what follows, two exemplary studies that have a similar research subject to this thesis are introduced. From different perspectives, they deal with the tricky issue how social narratives can be connected to the formal evolution of housing. In these studies, the house is seen not as a mere reflection of an externally predetermined cultural system but as a potential generator of social interactions and architectural change. It is expected that the analysis of these studies can provide some proper viewpoints for this thesis.

Michael Ann Williams (1991) takes an ethnographic approach to the investigation of formal change in the folk dwellings of southwestern North Carolina in the nineteenth and twentieth centuries. Based on interviews with the local people who lived in this period, she portrays how the change of dwelling type through time was associated with their actual living at home. In North Carolina, the earliest home life in a 'single pen plan' was re-accommodated in a 'double pen plan' and then in a 'centre-passage I-house' during the nineteenth and twentieth centuries. Williams finds out, with reference to local people's memory, how spatial image and actual use were expressed by verbal language. For example, the term 'big house' indicated a major living area within a single pen plan rather than a house scale or type, and 'front room' and 'back room' a space for living and a space for sleeping respectively in the double pen plan, though they were equally accessible from the front door or doors.

During the period of double pen plans and the time of their replacement by 'modern' bungalows, Williams observes two distinguishable types of change in housing culture: one related to domestic behaviour and the other to the physical form of the house (figure 2.4). The double pen plan, which inherited the 'hall and parlour style' of living in post-medieval England, went through a change in spatial use around 1910 while the house structure remained the same; the hall, an intensive living space, absorbed the formal functions of the parlour, acquiring the more formal names, 'sitting room' and 'front room', while the other room completely became a sleeping space with a new label, 'back room'. Thus, profound changes in spatial use occurred without the physical modification of the double pen plan house. In other words, 'spatial change was characterised not by rebuilding or remodelling but by "rethinking" the house (Williams 1991, 89).

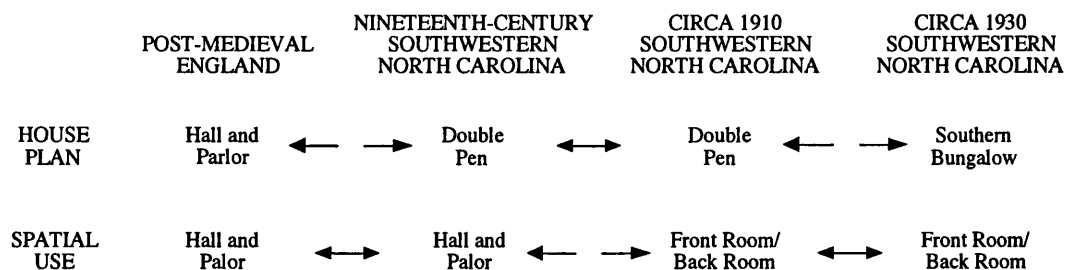


Figure 2.4 continuities and discontinuities in house plan and spatial use (Williams 1991, 91)
; some graphic errors in the original text was corrected with kind permission from the author.

A completely different type of change occurred in the 1920s and 1930s, when the new popular bungalow style was introduced; it was built using a new construction method and materials and now the narrow gable side was facing the front. Although the building looked different, the similar type of two-room arrangement in it enabled the local people to preserve the old way of living; thus the same front room/ back room practice was replicated in it. Hence, the bungalow house, which physically appeared to be a 'major break' in building traditions in the early twentieth century, was perceived as a 'slow and incremental' change to the local people who maintained the same spatial use (Williams 1991, 90). Synthesising these two observations, Williams noted:

"Overall the history of the double pen house in southwestern North Carolina shows a balance of continuities and discontinuities in house plan and spatial use. Periods of discontinuity in house plan are marked by continuity in spatial use, while the major change in spatial use was countered by a period of stability in house plan. The trend is neither wholly toward conservatism or innovation but a balance of the two. By understanding this balance, rather than focusing only on physical changes, we may better comprehend the nature of tradition and change in folk architecture." (Michael Ann Williams 1991, 91-2)

Another peculiar thing Williams observes is that the central-hall I house, which was not commonly built in the area, imposed a somewhat different social effect on the rural people in southwestern North Carolina. Normally, the advent of the central hall is accepted by scholars as a reflection of social desire for control, privacy, and egalitarian imagery (see Glassie 1975, 189). Unlike this generally accepted conceptualisation of the hall, its meaning and use seem to be different for the rural people. Williams finds in many cases that the hall was enclosed within a living space by demolishing its wall, or its width widened for another use other than passage. She even finds cases where some families moved back to an old double pen house from the central hall I house – thus going against the chronological order of housing development. These observations imply another important issue that the evolution of material culture does not proceed in a straight, one directional way; depending on each particular context, it can deviate, diverge, and sometimes even regress.

Williams' work seems to be successful in reconstructing the home life in southwestern North Carolina in the nineteenth and twentieth centuries. Through interviews with the inhabitants, she discovers what actually happened inside the private domains. This understanding enables her to see the changing process of the house morphology from the

inhabitants' viewpoint. Her research strengthens the point, which was made in the previous section: it is neither house form nor inhabitants' behaviour alone but the synthesis of these two that makes it possible to truly understand the transformation process of housing culture, and the interpretation should be context-dependent since there are always particular cases that do not conform to the general pattern of change.

Henry Glassie, in his seminal book, *Folk Housing in Middle Virginia* (1975), displays a highly analytical way of seeing the housing evolution. From the influence of Chomskian generative grammar, he develops a system of compositional rules by which small architectural components are arranged and built up to become all the types of folk housing in Middle Virginia. What controls and generates this grammar, he argues, is 'the architectural competence' which is active at the unconscious level in a designer's mind. According to him, competence proceeds, with the designer's geometric repertoire, 'from the abstract to the concrete, from useless ideas to livable habitations' (Glassie 1975, 19).

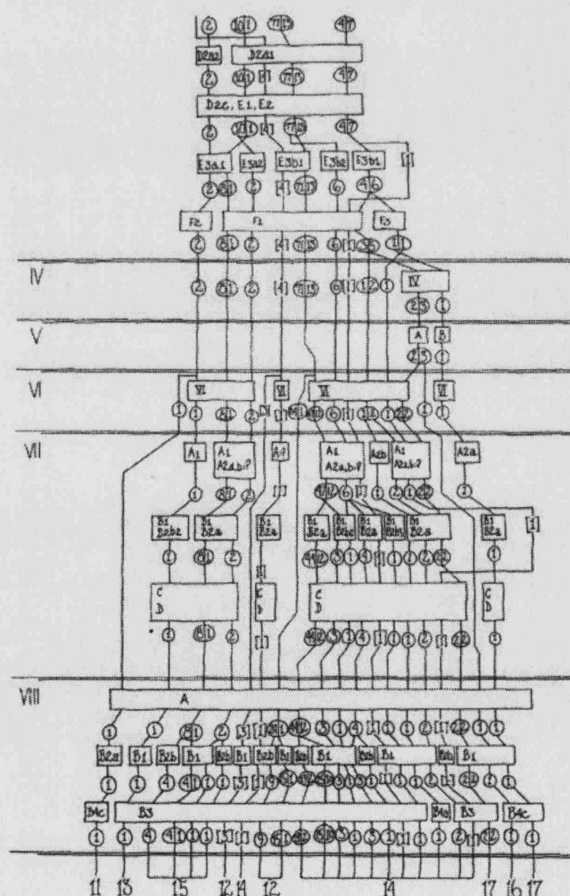


Figure 2.5 Part of Glassie's generative grammar of the transformation of the XY3X base structure into types 11 to 17 (This is one of five diagrams showing the transformation process. In the circles are the numbers of houses to which the rules in the rectangles apply, and in the brackets are the number of 'ungrammatical' houses)

As shown in the diagram, as one proceeds from the top to bottom, a ground plan evolves to become various types of three-dimensional house. Using five different diagrams, but applying the same rule sets, he shows that all 157 folk houses in the area could be generated.

Glassie expands his idea of competence to explain the change of house form through time (figure 2.6). He cautions against setting up the time phases of change in terms of 'things' for 'statistical convenience' because the chronological ordering of material manifestations is merely a 'static series that sidesteps change'. Thus, he notes that what changes is not "individual products of the competence, but the rules in the competence." (Glassie 1975, 111).

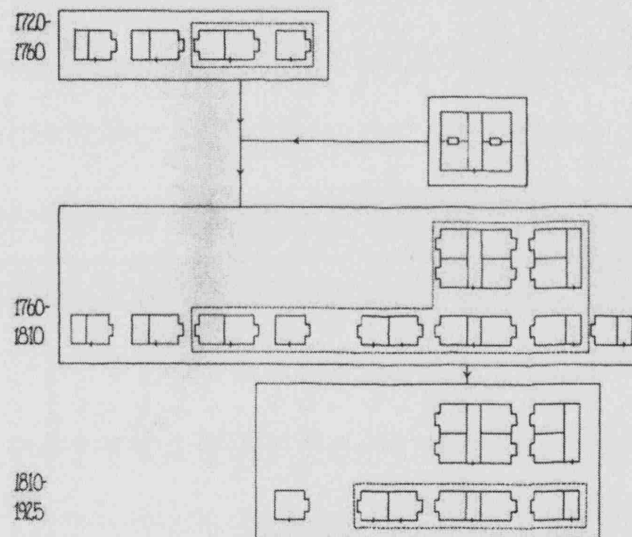


Figure 2.6 Evolution of the architectural competence (Glassie 1975, 110)
(statistically important forms are enclosed by broken lines)

As in the figure, therefore, Glassie divides the time of traditional houses into three phases based on the change in competence. The first phase is the time when the houses were English 'hall and parlor' plan (1720-60), the second phase when the Georgian central hall type influenced the plan repertoire (1760-1810), and the third phase when the central-hall I house became dominant (1810-1925). In the revolutionary second phase, Glassie notes, some rules had to be added to the competence to cope with the new Georgian style, while all the existing rules remained in effect. As a result, these expanded rules could create not only old types and new types, but also 'the compromises between'. In the last period of evolution, the hall and parlor types were abandoned and

the Georgian type was not commonly built; instead, the central-hall I house, one of the 'compromises', became dominant.

Glassie conceptualises this meaningful pattern of cultural change as a dialectic process, i.e. phase I (balance), phase II (disequilibrium-expansion-synthesis), and phase III (contraction-new balance) (ibid. 112), and suggests that this theory could be applied to other cultural changes. In fact, Glassie's research suggests a useful model for this thesis, and the conceptual frame of 'competence' will be utilised for the analysis of modern apartment houses in Seoul (see chapter VI).

A comparison of Glassie and Williams reveals some valuable suggestions for research into changing material culture. While Glassie's research is analytical and systematic in terms of investigating the logic behind the material object, it does not relate back to the everyday life of the society that produced that logic; in other words, designers' competence is not connected to inhabitants' spatial use and behaviour. Williams' research, by contrast, emphasises the actual use of space but architecture is seen merely as walls and partitions dividing and blocking human actions. In this case, houses are simply categorised into a small number of distinguishable types, i.e. single pen, double pen, and central hall I house, while the formal or geometric variations within each category, which is highlighted in Glassie's grammar, tend to be ignored.

These two approaches are powerful ones in that they reach far beyond the typological and historical dimensions of research into the American folk house. If the behavioural interpretation of domestic space can be rooted in the morphological analysis of the house, and thus the two approaches of Glassie and Williams can be put together, more insightful investigation is possible.

2.4 Design mechanism and grammar

As seen in Glassie's generative grammar, design is a process where the shape components are manipulated so as to achieve satisfactory results by the guidance of the designer's competence. Mitchell (1990) argues that design is a trial-and-error process where candidate solutions are sought and then evaluated for acceptability. He continues

that, in computational terms, such a process needs 'a generation mechanism, a test mechanism, and a control strategy, and 'design intelligence may be located either in the generation mechanism or in the test mechanism' (figure 2.7).

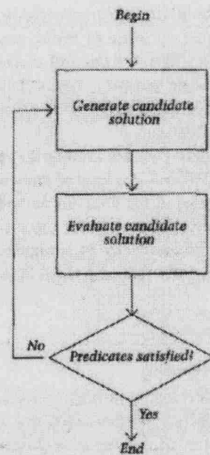


Figure 2.7 The basic trial-and-error structure of a design process (Mitchell 1990, 180)

In the former case, the rules of the grammar are so reliable that solutions with high acceptability are quickly produced, and in the latter case, the evaluation mechanism has to cautiously sort out the tentative solutions which were indiscriminately produced. Mitchell further notes:

“In other words, you can get acceptable results by combining smart designers with dumb critics, or by teaming smart critics with dumb but energetic designers. You may prefer God (a smart designer with no need for a critic) or evolution (indiscriminate generation but deadly effective criticism).” (Mitchell 1990, 180)

In the case of Glassie's generative grammar, it certainly leads to the actual solutions found in Middle Virginia, but at the same time it has a potential to generate a wide range of other possibilities that also satisfy the grammar. The grammar itself therefore is close to the later case where the design intelligence is placed in the test mechanism since it can generate, exhaustively, all combinatorial possibilities conforming to its rules. At the same time, however, if Glassie's grammar is well-defined, it could filter-out irrelevant solutions, thus minimising the chances of abandonment. In this later case, the grammar endows the generation mechanism with more powerful design intelligence.

The formulation of a well-defined grammar depends on how deeply one understands the style he wants to create. Such an ideal grammar is the one that accurately represents the innate commonalities of a class of buildings with simplest rules. In research, where unknown rules should be extrapolated from a range of building forms, formulating a grammar is a hard task which cannot guarantee authenticity. Concerning this, Glassie notes:

“If the rules that emerge during the attempt to indwell in other minds account completely for observable phenomena, the chances are fair that many of them coincide, in truth, with the mental acts of the creators of the phenomena; and at least a possible, partial explanation for the phenomena has been constructed.” (Glassie 1975, 20)

‘Shape grammar’, a conceptually similar yet more sophisticated grammar has been formulated by Stiny (1975) and Gips (1975). Whereas Glassie’s grammar can be characterised as dealing with ‘gross architecture’ in that it excludes details and uses linguistic descriptions to define rules, shape grammar can be characterised as dealing with all levels of detail and as using mathematical descriptions to define rules. *Shape grammar* also simulates the design mechanism based on the conceptual analogy of the grammar in language, and became more refined when the concept of *parametric shape grammar* as an extension of shape grammar was introduced by Stiny (1980). Shape grammar has four components: *S* is a finite set of shapes; *L* is a finite set of symbols; *R* is a finite set of shape rules; and *I* is an initial shape (Stiny 1980, 347). As a shape rule ($\alpha \rightarrow \beta$) is applied, the shape on the left (α) is replaced by the shape on the right (β). By successive application of shape rules, dimensionless plan schemata, for which proportions or dimensions can be assigned, are generated.

A simple shape grammar and its application to generate forms are presented in figure 2.8. By means of the parametric shape grammar, Stiny and Mitchell (1978) formulate a grammar which could generate the house plans of Palladio in the 16th century (figure 2.8). In the generation mechanism of shape grammar, what is generated is not just the actual projects, but other shapes that were never designed by Palladio. If this redundancy in outputs still converges to the intended style, then the grammar can be evaluated as successful and, as mentioned above, this well-defined grammar can be a powerful tool to comprehend the compositional logic of the style.

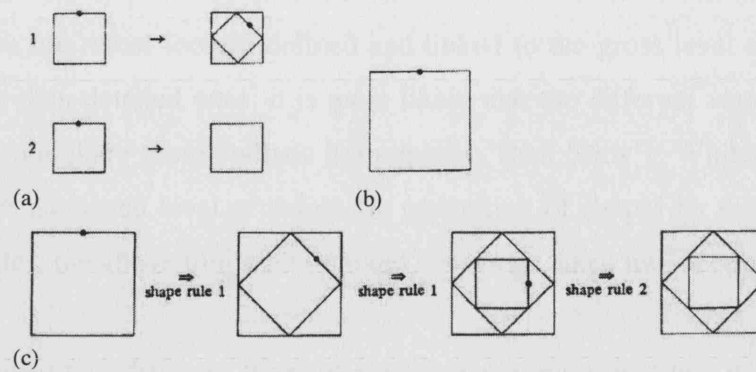


Figure 2.8 Simple shape grammar that inscribes squares in squares
(a) shape rules (b) initial shape (c) transformation process

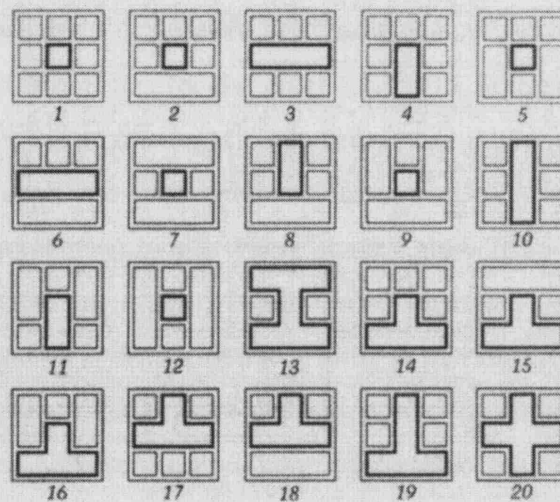


Figure 2.9 Complete set of 3 by 3 plan layouts produced by Palladian shape grammar
(villa Argarano, one of Palladio's real project, appears as number four)

Despite this potential strength of shape grammar, however, it certainly has some limitations. First of all, shape grammar fails to be linked to the 'historical understanding of those styles' since it focuses on 'form for itself' (Johnson 1991, 35). This is the point which distinguishes Stiny's grammar from Glassie's; in his grammar, Glassie actively tried to relate his rules to the historical background. Secondly, from a technical point of view, each rule in the grammar is, in a sense, arbitrary because any shape rule schema can be accepted as long as it serves to lead the generation process to the intended form of design. In other words, there could be many different versions of Palladian grammar, all containing real Palladian projects but each of them having a different set of shape redundancy; thus some versions might generate too many plans that cannot be seen as the true Palladian style.

Glassie's grammar also has the same problem of arbitrariness in defining each rule but since the rules are rather loosely defined and linked to the gross level of constructional actions rather than detailed ones, it is more likely that the different versions of possible grammars would share more stylistic homogeneity than Stiny's. While shape grammar allows a more advanced level of automatic generation of shapes by means of precisely modulated rules, the above limitations should always be taken into account.

Having reviewed two different types of shape generating grammars, it must be pointed out that in real practice design is not a mechanical process of putting independent components together to make a whole. Rather, design evolves from certain pre-images that come from a designer's experience and knowledge. Even if Glassie formulates a sequence of transformation rules for the creation of folk houses, he notes that cultural norms already exist in the architectural competence, and thus the designer may 'start at any point, take any route, and yet come to the same end' (Glassie 1975, 33-7). Indeed, design is not an incremental process where shapes grow from a void by following a sequence of rules. On the contrary, it starts with 'conjecture' which arises from 'pre-existing cognitive capability' or knowledge (Hillier et al 1984). In this respect, the plan-generation models, which have been discussed above, should be seen as purely theoretical. They are, however, useful conceptual tools to gain an insight into the architectural design process, and for this reason, some of the concepts will be utilised for the analysis of the sample plans in this thesis.

Steadman (1983, 133) suggests a five-level hierarchy for the classification of plans (figure 2.10). It is a virtual catalogue of design which a designer consults to find arrangements corresponding to his requirements. Although the exact structure of the hierarchy would depend on 'the particular interests of the users' as Steadman notes, this model at least reflects the modern approach to design.¹ This hierarchic taxonomy, by separating architectural properties into different levels, can make the classification of building types more efficient and render their morphological change in history more noticeable.

¹ "It might with justice be argued, on the other hand, that this suggested form of a classification of plans has a distinctly 'functionalist' flavour. It echoes the typical modern movement or 'design methods' approach, starting from a 'programme of requirements' stated as a list of rooms, which are then related together by means of a 'functional diagram' or 'bubble diagram' (the graph), and finally given precise shapes and sizes." (Steadman 1983, 134)

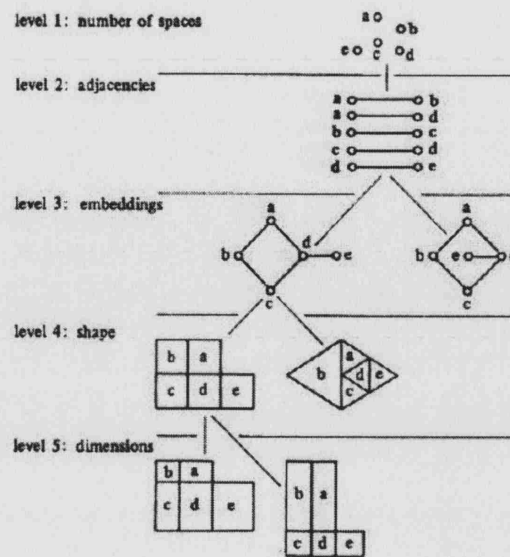


Figure 2.10 Five level hierarchy for the classification of plans (Steadman 1983, 133)

At level 1, rooms are separate entities as a set of required spaces. At level 2, adjacency requirements are introduced as partial topologies. Embeddings in level 3 represent the whole topology of the elementary spaces or rooms; providing information about relations between spaces, whilst eliminating their real distances or geometry. At level 4, shapes are introduced; they may be a combination of rectangles or triangles without dimensions, as shown in the figure. They are assigned dimensions, or rather a complete geometry, in level 5 where the shapes become final products of the whole design process. Shape grammar, reviewed above, is a transformation process to formulate shapes mainly in level 4 before the allocation of real dimensions. In searching for the compositional logic in morphology, level 3 is particularly useful. This is because a graph as an embedding of a shape provides the simplest way of representing the whole; put differently, a minimum amount of graphical information can show the relational structure of an entire system. Therefore, graph theory, the literature of which will be reviewed below, has benefited many designers and researchers across disciplines.

2.5 Floor plan morphology and graph theory

It has been suggested early in this chapter that research into housing, especially when it is concerned with historical change, should be rooted in the material analysis of the house itself as an object. In the previous sections, therefore, two architectural grammars were presented and compared to show how the morphological research on housing could be related to the design generation mechanism. In this section, a further review is made on the analytical methodologies for the investigation of house plans.

For the analytical analysis of plan morphology, scholars needed a simple yet powerful representation apart from the conventional way of metric representation. In their pioneering book on this issue, *the Geometry of Environment* (1971), March and Steadman proclaimed the reason for this approach:

“Perhaps the chief difference between the traditional treatment of geometry in architecture and the one presented here, is that, previously, geometry was employed to *measure* properties of space such as area, volume, angle, whereas the new mathematical theories of sets, groups and graphs – to name but a few – enable us to describe *structural relationships* which cannot be expressed in metrical forms, for example, ‘adjacent to’, ‘in the neighbourhood of’, ‘contained by’.” (March and Steadman 1971, 8)

Graph theory was first applied to small architectural plans by Levin (1964) in his article, ‘use of graphs to decide the optimum layout of buildings’. Here, Levin used access graphs in which the vertices represent rooms and the edges the connections between rooms. Some others, including Cousin (1970) and Friedman (1975), have tested the application of graph theory to design, but it was March and Steadman (1971) who made a significant contribution to the utilising of the mathematical concept of graph theory as an instrument for architectural thinking. They emphasised the importance of this new approach by showing three house plans designed by Frank Lloyd Wright (figure 2.11). Although these houses have completely different appearances in terms of the ‘traditional treatment of geometry’, when converted into graphs where points represent functional spaces and lines their connections, strikingly, they begin to appear topologically equivalent.

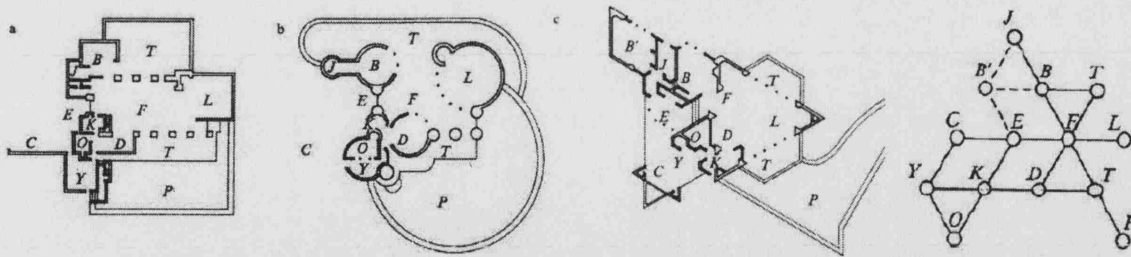


Figure 2.11 Three house plans by Frank Lloyd Wright and a graph showing their equivalent room connections

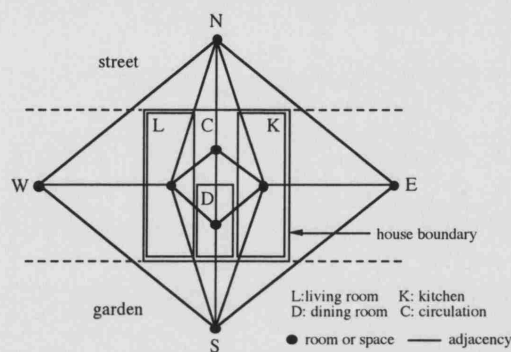


Figure 2.12 Adjacency graph for a hypothetical terrace house (reproduced from March and Steadman 1971)

In the same book, March and Steadman also explored many possible ways in which graph theory could be adapted to design problems. For instance, they showed how a rectangular terraced house can be planned in accordance with given room-adjacency requirements, and thus why the 'planarity' of graph is the pre-requisite for the realisation of candidate solutions (figure 2.12).

Some scholars, working thorough this line of thought, have ^{examined / studied?} questioned about the relationship between adjacency and access in buildings. Bon (1972) took a sample of seventy North American dwellings and examined the proportion of access against adjacency (Steadman 1983, 185). Since the access graph is a subset of the adjacency graph, the proportion of access against adjacency can show how many adjacency links are used for spatial communication, i.e. doors and other openings. In Bon's sample, it was found, that 47% of the adjacencies between rooms were doors. Brown and Steadman (1991) applied this measure to a British housing sample and found that this 'communication ratio' is higher than ⁱⁿ Bon's American sample and varies across house types and floor levels.

Some researchers have tried to analyse the historical changes in housing culture using these lines of morphological thought. Dickens (1977) examined a sample of seventy four small house plans in Cambridgeshire. First, he sought the theoretical possibilities of plan layout using rectangular cells that represent major spaces without circulation space and compared them with the sample plans to find out that not all the layout patterns were actually used (see the top row of figure 2.13). He then hypothesised that the reason for this 'restriction in the number of theoretical alternatives' can be ascribed to the tendency towards compactness in plan and economy in construction (Dickens 1977, 36). Next, access graphs for these two story houses were drawn for the sample with zig-zag lines indicating staircases, and they were sorted according to the layout patterns previously found (figure 2.13). He divided the whole period into 50 years and marked the number of occurrences of these access graphs in each period and found there was statistical significance for some graphs in the time of their occurring.

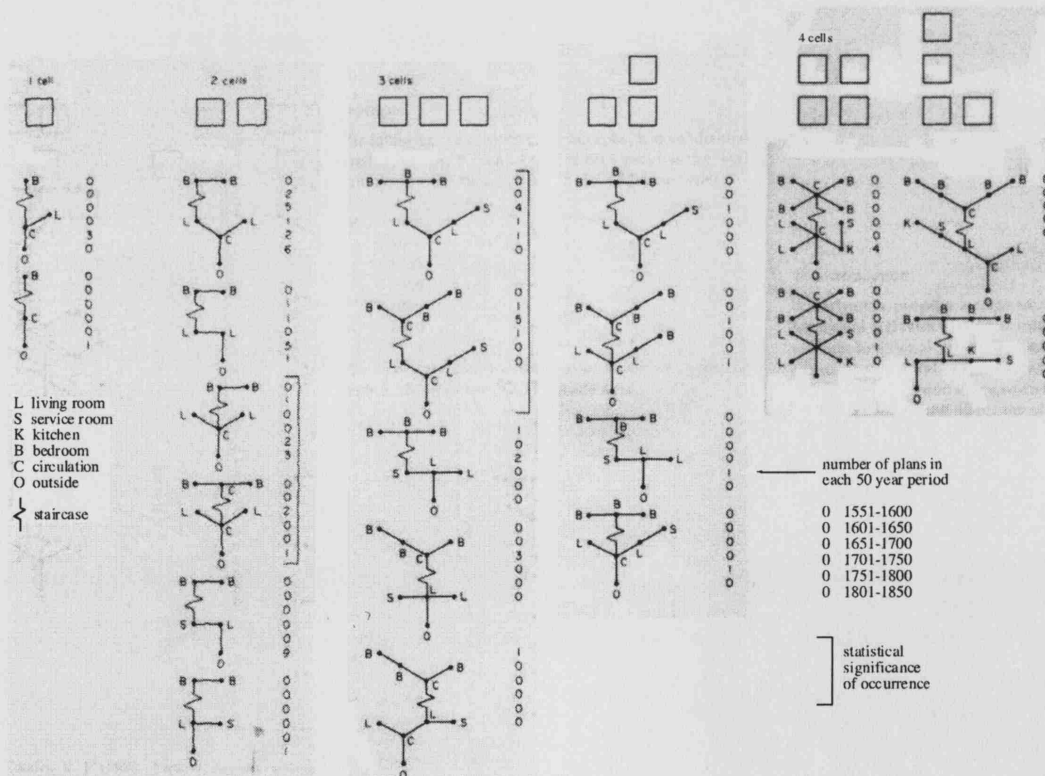


Figure 2.13 List of observed graphs sorted by their plan layout
(to the right of each graph is the number of occurrence in each 50 year period)

Hillier and Hanson took a further step in using graph theory. They brought its graph technique into their spatio-social theory, space syntax, to measure and evaluate properties of the built environment. Before the detailed account on space syntax theory

in the next section, one of their exemplary projects needs to be outlined for the current discussion of the development of graph theory in architectural research.

Hanson (1998)² examined (the possibility on) how far the typology of residential buildings based on the access graph analysis could be parallel to the social changes in the periods of their construction. She took the house plans of the Banbury region of Oxfordshire in the seventeenth century assembled by Raymond Wood-Jones. In his original study, Wood-Jones distinguished the house plans into two types, i.e. the 'through passage' plan and the 'porch' plan, where the former has a through passage running from the front door to the back door separating the kitchen from other living spaces and the later a large back-to-back chimney stack and a porch together separating the parlour from other living spaces – the typical types of these are (a) and (b) in figure 2.14. Despite this clear distinction between the two types, in Wood-Jones' sample were many puzzling plans that do not easily fall into these two categories [see plan (c) and (d) in figure 2.14].

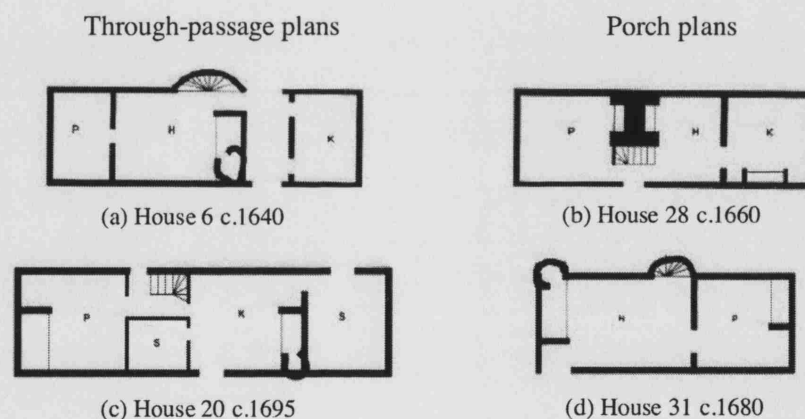


Figure 2.14 Wood-Jones' plan typology for the Banbury region in which plan (a) and (c) are classified as through passage plans and (b) and (d) as porch plans (H=hall, P=parlor, K=kitchen, S=service area)

Hanson transcribed these plans into the 'justified graph' format where vertices are arranged by their depths from the exterior. Taking into account the configurational pattern of graphs and the position of rooms, they categorised the plans into four categories, i.e. 'through passage plans', 'single entry plans', 'multiple-entry plans' and 'sequenced plans' (figure 2.15).

² First written by Hanson in 1979 as a mimeograph in the Unit for Architectural Studies, Bartlett School of Architecture and Planning, University College London

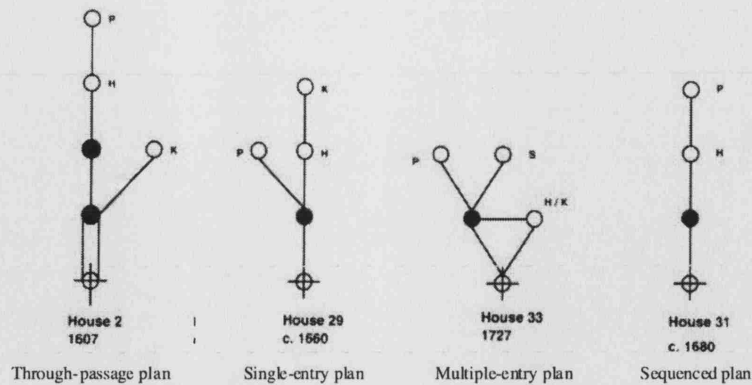


Figure 2.15 Four typical justified graph types by Hanson's configurational typology (those four plans in figure 2.14 can be re-categorised into these four types; black dots = transitional space)

By mirroring the social changes in the seventeenth century to the plan morphology, Hanson related different types of household structure and lifestyle to each category of plans. Based on the differentiation of social status by wealth after the middle of the seventeenth century, she associated the unprecedented multiple-entry plans which have ringy and shallow configurations to more wealthy Banbury yeoman farmers and the sequenced plans which inherited the regional style of the through-passage plan, i.e. the deep sequencing and branching principles, to poorer peasants.

Next, with reference to Lawrence Stone's book, *The Family, Sex and Marriage in England, 1500-1800*, she related the through-passage plans, which put the parlour in the deepest area for the head of the family, to the 'open lineage family' in the early seventeenth century; the single-entry plans, which segregate women by putting the kitchen in the deepest place, to the 'restricted patriarchal nuclear family' around the middle of the seventeenth century; and the multi-entry plans, which reflect the enhanced women's status, to the 'closed domesticated nuclear family' that appeared from the late seventeenth century. This is not the space to deliver a detailed account on these relations, but it should be noted that in Hanson's argument the access graph takes an essential role to shed light on the socio- cultural dimension imprinted in architecture.

Hillier and Hanson's approach of utilising graph theory for the interpretation of cultural aspects of built environment has been widely accepted in many different projects across disciplines including architecture, archaeology and anthropology. For example, by means of the justified format of ^{the} access graph, Brown (1986) illuminated the changing characteristics of the domestic space in seventeenth-century London; Chapman (1990)

tackled the problem of the archaeological interpretation of Bulgarian tells; and Blanton (1994), in his comparative study, analysed house plans from different parts of the world to find out their links to each cultural system from the anthropological perspective. The meaning of Hillier and Hanson's approach is that they found the 'social' within artefacts. By bringing to light the dimension of 'depth' from access graphs, they opened the possibility where the pure morphology could be linked to the dimension of the 'social'. In the following section, their theory and method are explained and analysed.

2.6 Space syntax: theoretical statement and critical evaluation

It has been suggested that to reveal the cultural dimension of housing that tends to have multiple meanings, research should be rooted in the very nature of buildings themselves, and following this line of thought, many studies, which put an emphasis on morphology, have been reviewed. In most of the studies reviewed, the analyses of housing morphology could be effectively connected to the architectural level of interpretation, e.g. building typology, design grammars, and so on. Apart from Hanson and Hillier's research, however, they seemed to have less analytical consistency in linking their analysis to the socio-cultural level of interpretation. How, then, can a morphological aspects of housing be connected to the abstract notion of society or culture? The possibility can only arise when the spatial organisation of the house is seen as following a certain social order:

"The only possible exception, the only true social theory that could come out of architectural studies would necessarily be closely related to the most important characteristic the built environment possess: its capacity to order space and organise human contact. Such a theory could only be developed from a method of describing and measuring the space of buildings." (Samson 1990, 6)

According to Hillier and Hanson (1984), the typical problem in architectural studies can be epitomised as a 'man-environment paradigm' in which the social dimension is separated out from architecture. Confined in this paradigm, the existing architectural studies have moved the problem definition to the wrong position where 'space is desocialised at the same time as society is despatialised', and thus 'the former being reduced to mere inert material, the latter to mere abstraction' (Hillier and Hanson 1984, 9). For Hillier and Hanson, space is seen not as a static reflection of already existing

society; rather it is seen as being created within the process of social change and further as affecting the social change:

The most far-reaching changes in the evolution of societies have usually either involved or led to profound shifts in spatial form, and in the relation of society to its spatial milieu; these shifts appear to be not so much a by-product of the social changes, but an intrinsic part of them and even to some extent causative of them. (Hillier and Hanson 1984, 27)

By detecting the social dimension framed within the pure state of architecture, therefore, the space syntax theory, developed by Hillier and Hanson, can bridge the gap between the architectural analysis and the cultural interpretation. The theory is based on the idea that it is through 'configuration' that a cultural pattern of activities is embodied into material culture. Thus Hillier notes:

"One thing is clear. Encountering, congregating, avoiding, interacting, dwelling, conferring are not attributes of individuals, but patterns, or configurations, formed by groups or collections of people. They depend on an engineered pattern of co-presence, and indeed co-absence. Very few of the purposes for which we build buildings and environments are not 'people configurations' in this sense. We should therefore in principle expect that the relation between people and space, if there is one, will be found at the level of the configuration of space rather than the individual space." (Hillier 1996, 29-31)

In space syntax, to measure and evaluate configuration, first, the justified format of the access graph is drawn. The strength of the justified graph lies in the fact that it can reveal inherent structure of space that is hard to comprehend from a visual investigation of the plan (figure 2.16). From the figure, it is recognised that those four buildings with the same geometrics and adjacency graphs are completely different in terms of access configuration. It is intuitively noticeable among the four graphs that graph (c) is the most integrated from the standpoint of the original space at the bottom since all the spaces are tightly linked to it making the system shallow. In contrast, graph (d) is the least integrated for the opposite reason: the points are in general lining up in a sequence getting farther away from the original space thus making the system deeper.

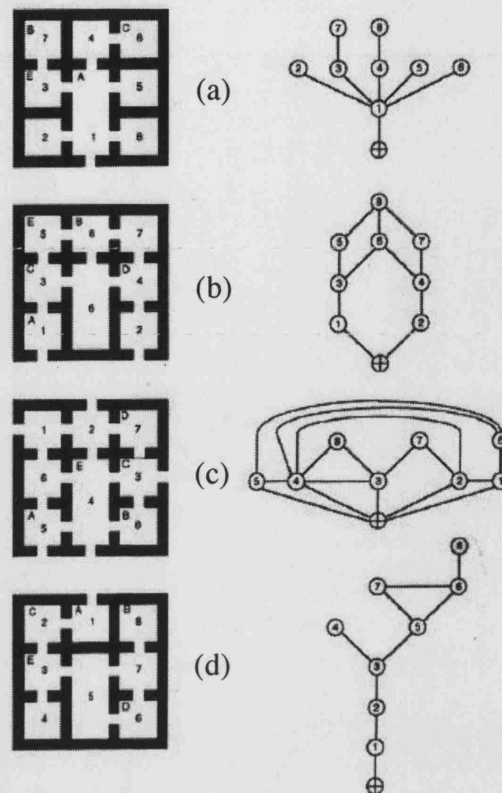


Figure 2.16 Four hypothetical plans and their justified graphs from the exterior
(from Hanson 1996, 25-26)

The degree of 'integration' can be mathematically measured, in three steps, based on the justified graph. First, the mean depth (MD) is calculated by summing up all the depths from the original point to all the others and dividing them by the number of the points less one. Second, relative asymmetry (RA) is calculated from the following formula in which k is the number of points: $RA = 2(MD - 1) / (k - 2)$. This is to compare "how deep the system is from a particular point with how deep or shallow it theoretically could be" (Hillier and Hanson 1984, 108). Third, to deal with different sized systems, real relative asymmetry (RRA) is calculated by dividing the previous RA value by the RA value for the origin of a 'diamond-shaped' pattern³: $RRA = RA / D_k$. While this calculation for RRA quantifies the original space, when the RRA values for all the points in a system is averaged, the degree of integration of the system is acquired; it is called 'mean RRA'.

³ It means "a justified map in which there are k spaces at mean depth level, $k/2$ at one level above and below, $k/4$ at two levels above and below, and so on until there is one space at the shallowest (the root) and deepest points." (Hillier and Hanson 1984, 111-112)

This simple measure of integration has been proved to be a powerful tool to explain the social dimension of the house. A space in the house that has the highest degree of integration (thus having a lowest RRA value) can be accessed easily and quickly from the other spaces under normal conditions. This means that the space has a potential to have controlling power over the whole domestic space. In contrast, when a space has the lowest degree of integration (thus having a highest RRA value), it is less accessible due to its topological distance farther away from the others – thus most segregated in the house. In this later case, the movement of going into and out of this space can be more easily controlled. The assignment of functions to these spaces that are syntactically different tends to follow, to some extent, socio-cultural norms. In many modern apartment houses in Seoul, for example, central halls and living rooms tend to be found in more integrated locations while balconies are found in more segregated locations in terms of their syntactic values. When the numerical variation of syntactic values follow a certain order across a sample, then it can be said that the houses share a social logic indigenous to that culture. This ‘numerical consistency in spatial patterning’ is called ‘a housing genotype’ (Hanson 1998, 32). As Hanson put it:

“Functional patterning was imprinted into the physical and spatial form of the house. We might best think of this not as a background to behaviour but as a record of behaviour transmitted through the building, perhaps through several generations. Configurational analysis of plans can be conceived of as an ‘archaeology of space’. If houses display configurational regularities then the buildings speak directly to us of culturally significant household practices which have been crystallised in the dwelling in the form of an integration inequality genotype.” (Hanson 1998, 38)

Through the biological concept of genotype, space syntax distinguishes the spatial pattern in the domestic space from the superficial form of the house, which is subsequently defined as a phenotype; thus the structural distinction between genotype and phenotype is made where the former carries the social meaning of dwellings while the later is relegated to an individual variation of the former at the surface level. The fact that configuration is rendered, over the other characteristics, as the single most essential feature of dwellings to find the socially significant genotype has been the main point of criticism against space syntax. The criticism can be divided into two categories: the first one is scepticism about its direct connection to social interpretation without the consideration of context, and the second one relates to its geometric reduction to topology, denying the implication of form.

In the first category of criticism, the argument is made at a theoretical level that space syntax is too formalistic in its approach to reveal the social dimension of dwellings (Hodder 1986, Boast 1987, Lawrence 1987, Brown 1991, Johnson 1993). It is argued in this criticism that the theory relies exclusively on configuration making spatial patterning and social meaning as a one-to-one relationship while ignoring the context and changing meaning through the passage of time. For example, Lawrence (1987, 53) argues that space syntax analysis is misleading because the spatial characteristics of dwellings are 'interpreted as fixed objects by a static abstraction that overlooks their life history'.

This line of criticism, however, seems to have neglected to deal with the basic concept of the theory and the related projects dealing with a variety of socio-cultural contexts. Throughout their book, *The social logic of space* (1984), Hillier and Hanson show how different social meanings can be assigned to the spatial structure of houses and settlements in association with different geographic and historical contexts. Hanson's study of the seventeenth century English house in the Banbury region, which was reviewed in the previous section, shows another example. In her study, the deepest position in the house is interpreted as having more than a single social meaning: in the through-passage plan the parlour in the deepest position signifies the status of the household head, while in the single entry plan the kitchen in the deepest position was to control women. Obviously, the criticism yields no productive debate on the theory and only brings the issue of context that has been already discussed and established within the theory:

"The simplest of space configuration can support complex, many-layered and evolving meanings which can be assigned and reinterpreted by different individuals and groups, be they located within the culture or commenting on it from the outside." (Hanson 1998, 78)

In the second category of the criticism, it is argued that space syntax, confined within the genotype-phenotype paradigm, disregards the formal side of the built environment that is inseparable for the understanding of the whole (Boast 1987; Boast and Steadman 1987; Brown 1990; Blanton 1994). In other words, by the action of 'stripping back' of the formal aspects that might affect the spatial configuration, space syntax 'excessively limits the field of exploration' (Boast 1987, 452). The best example for such an argument

can be found in several studies dealing with the narrow-frontage British houses (Brown 1986, 570; 1990, 96; Brown and Steadman 1991, 407). In these historic and contemporary house plans, the narrow frontage, which is caused by the restricted condition of the site geometry or the building form, has affected the spatial organisation of the interior and, as a result, entailed a long sequenced access pattern (figure 2.17).

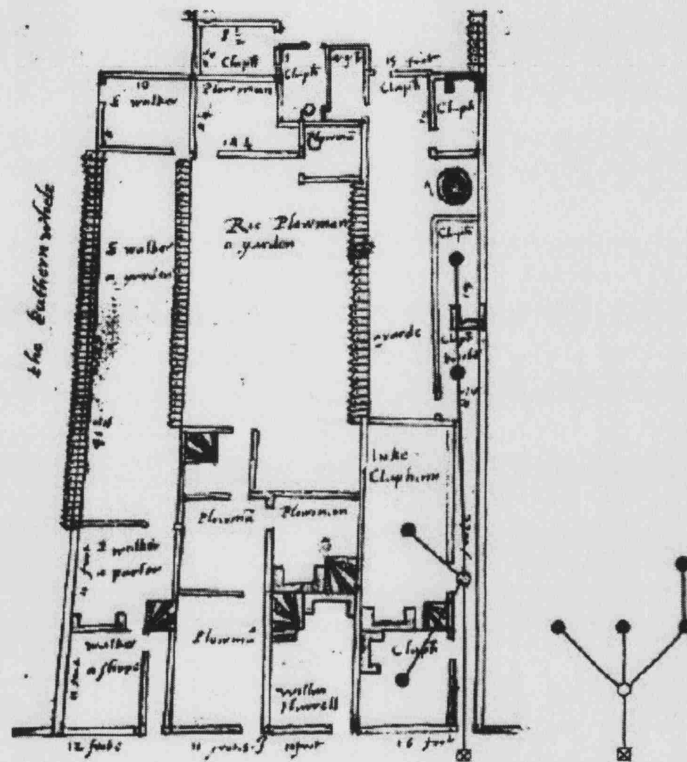


Figure 2.17 House plans in seventeenth-century London (from Brown 1990, 98)

In special circumstances like the one above, it is true that the building form becomes a strong modifying factor in the design of the internal configuration. This does not, however, indicate the methodological limitation of space syntax. On the contrary, if an interpretation can be linked to background information, a topological analysis still can be the most powerful tool to reveal the social dimension. Even in the above studies, the authors turn to the justified graph representation to effectively show the effect of geometric constraints.

Any social research should be rooted in the context of its subject and space syntax research is no exception, and any variables including the formal aspects of the house should be taken into account depending on that context. As will be shown in chapter 5, in the modern apartment houses in Seoul, the typical slab type of building structure

constrains the freedom of unit planning, and therefore only a small number of possible plan configurations are repeatedly used. This is another case where the formal aspects should not be disregarded. In this thesis, therefore, to deal with this issue, within the theoretical framework of space syntax, formal aspects will be carefully investigated.

2.6 Summary and discussion

It has been noted early in this chapter that a research framework is needed to investigate the cultural dimension in housing. Several models that suggested research methods were introduced and criticised; in Lawrence's research model, even if a well-defined set of variables that affect housing culture is suggested, he did not provide a method for relating these to architecture. In Rapoport's model, he emphasised the importance of activities in architecture as a way to illuminate culture, but he failed to show how activities and architectural settings could be systematically related. Based on the premise that the house, as if a text, has multiple meanings which are also exposed to re-interpretations, it was suggested that the house should be examined in the first place as a thing in itself because what is unchanging is the very nature of its spatial syntax. In this respect, a number of studies on housing with an emphasis on morphological aspects have been reviewed. First, the works of Glassie and Williams on the transformation of the American folk houses were found to be suggestive approaches for this thesis in which the change in housing culture through time is the main concern. Second, while the other morphological researches failed to link housing to culture, Hillier and Hanson's space syntax was evaluated as a valid theory as well as a method for the argument of this thesis.

In chapter I, three research questions were asked: first, how is an old spatial organisation mapped onto a new setting that is formally and functionally different?; second, how is an old conceptual dimension in space transferred through a transformation process?; third, how is the spatial intuition from the past accommodated within the formal constraints of modern housing? These questions can be answered through the theoretical and methodological frameworks constructed in this chapter from the review of the existing literature.

Space syntax is the main theory that constructs the fundamental basis for the whole thesis; it is the only theory that fills in the gap between the morphological analysis and social interpretation. For the first question, relying on Rapoport's idea of 'system of settings and system of activities', the new spatial setting of the apartment houses in Seoul is compared with the old courtyard houses in the light of 'space-activity' interactions. The second question deals with how the symbolic dimension of 'level distinction' that is inherent in Korean domestic space for hundreds of years is transferred through the housing transformation process in the twentieth century, and the topological analysis of space syntax illuminates this intractable problem. The third question is to investigate the effect of the geometric restriction on the design mechanism of apartment houses in Seoul that intuitively follows the inherited space configuration, and for this, Steadman's ideas about plan morphology become the main source to build up the argument on this 'syntax versus form' issue.

Chapter 3

Houses in Seoul: the history and general characteristics

3.1 Traditional houses in Korea

3.1.1 Maru and ondol

3.1.2 Plans of the traditional houses

3.1.3 Traditional houses in Seoul

3.2 Development of modern houses

3.1.1 The urban traditional house (1930s ~ 60s)

3.2.2 The colonial houses (1941~ 45)

3.2.3 The public sector detached houses (1954 ~ 60s)

3.3 Apartment houses

3.4 The target area for research and the sampling method

3.1 Traditional houses in Korea

Korea has a total area of 220,848km² and is located at the northeastern rim of the Eurasian continent with its latitude ranging from 33°N~43°N (735km long) and longitude from 124°E~131°E (360km wide). It is a peninsula, a transitional region in which the characteristics of a continental country and an island country coexist. The geographic situation where it is adjacent to neighbours on both sides but at the same time isolated from them has implanted the dual tendencies of 'conservation and adaptation' (Jo 1968, 10-29). Housing culture in the Korean peninsula also reflects this duality; its housing culture, defined as being in the middle between those of China and Japan, has shown both adaptation to the natural environment and conservation of traditional forms without change until the early 20th century (Joo 1980, 6).

The climate of the country also shows a transitional trait where the continental and ocean climate coexist. The Korean peninsula has marked four seasons; compared to the western coasts of Europe at the same latitude, the temperature of summer is hotter and that of winter is colder (Oliver 1997, 877). The annual rainfall is 600~1500 mm and 50~60% is concentrated in the summer season from June to August. Because of the hot and humid summer and cold and dry winter, the Korean houses have developed two contrasted floor structures, namely *maru* (raised wooden floor) and *ondol* (floor heating system) for which a more detailed description will follow in the next section.

3.1.1 Maru and ondol

Maru can be simply translated as a raised wooden floor and ondol as a floor heating system. It is believed that maru and ondol have been developed from the south and the north of the peninsula respectively. Many historic documents testify that their origin can be traced back to around A.D. 300 (see Joo 1980, 27-39). In the north region, it was recorded that the elevated platform called a changgaeng – meaning a long duct – was installed partially in the living space for heating to endure the cold winter. Heat produced from fire is passed through under the platform and the inhabitants can stay warm by sitting and sleeping on it. This platform, which is a primitive form of Korean ondol can be found in some parts of China even today. In the north of China, for example, people

make an elevated platform called a *kang* – meaning a duct – which has the same function for heating as the one explained above (Knapp 1990, 9-10).

Maru, on the other hand, originated from the southern part of the peninsula where enduring the hot and humid summer is the major concern for the people. It is argued by many scholars that, early in its history, the purpose of raising houses on piles was for the storage of grain, to protect it from insects and humidity of the ground in summer. Then, people gradually adopted this structure for their own dwellings. In this process, unlike many south-eastern countries of Asia, the height of the floor has been adjusted lower to be positioned a few feet above the ground so that the dwellers can step up easily to the floor without ladders. In the traditional Korean house, maru is a semi-open space for summer which is open to a yard.

In the beginning, ^{the}maru and ^{the}ondol were not built together in the same house; the former was used only in the south and the later only in the north. It can be recognised, however, from the 12th century documents that both maru and ondol were spread over the peninsula and planned together in a house (Joo 1980, 40-44). Another important thing is that the elevated platform, the primitive form of ondol, had evolved to cover the whole floor of a room by this period and became the standard format of house heating (ibid. 43; figure 3.1). Since the stove is placed outside the room in this whole-floor heating structure, the room could be maintained more clean without smoke.

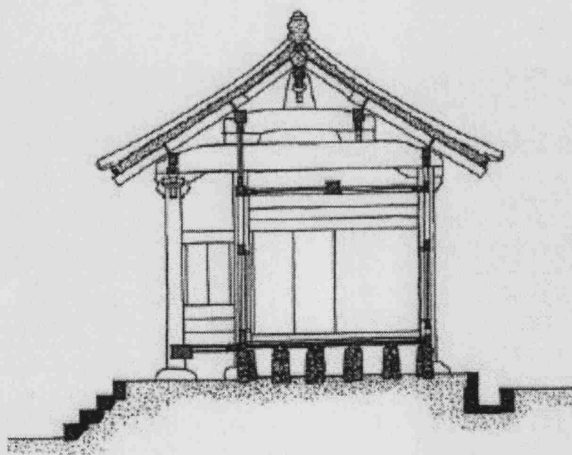


Figure 3.1 Section of a traditional Korean house built with ondol, the floor heating system (stone floor is raised on the masonry walls for heating; from Habraken 1998, 107)

At the time when the practice of constructing ondol and maru together in a single building was started, it must have been conceived as ^(a) best solution that they are raised to the same level so that they can be accessed easily from each other. With this probable reason, it became the convention that they were equally elevated above the ground more or less about the height of a human knee.

It is argued in this thesis that the determination of this height is crucial in understanding the indigenous level distinction between the clean elevated space and the dirty earthen spaces. It is highly probable that because the elevated space has the height of the sitting and sleeping furniture, i.e., chairs and beds, the whole raised floor is treated like “a piece of furniture”.¹ In Korean domestic space, those raised spaces, i.e. maru and the rooms with the ondol heating system are maintained extremely clean so that the inhabitants can always sit and lay down their bodies right on the floor without furniture. Therefore, shoes must be removed and placed in the lower earthen spaces before entering this clean zone.

Many southeast Asian countries have the raised floor as well, but since its level is much higher – above the human head in the case of the Thai house (Chongchairuk 2002, 48),² dwellers enter the house using ladders and therefore the raised floor is not regarded as furniture itself; instead, it is simply a living space on the first floor – equivalent to a second floor in the North American culture. In this sense, the cleanness of the whole raised floor is not a critical concern for them as it is in Korea.² Moreover, in the Korean traditional house, the floor is finished with oiled paper for ondol and polished wood for maru in order to make them easier to clean.

¹ This idea of ‘furniture’ came from the book, *Contemporary Japanese Architecture* (Botond Bogнар, Van Nostrand Reinhold Company, 1985, p.56). In the book, he describes the Japanese raised floor as “a piece of furniture” upon which one should remove shoes to walk. This expression looks ingenious in that it implies simultaneously its function and dwellers’ attitude to the raised floor. Moreover, this foreign researcher’s view of the raised floor is refreshing to the people living in that Far-eastern culture because, as Conner points out (Conner 1985), we are often “blind to cultural effects in our own familiar domestic settings.”

² In some of Thai houses, within the raised floor, the bedroom floor is raised again about 40cm from the adjacent verandah, thus making the room function as if it is a “bench” (Chongchairuk 2002, 48). From the fact, it can be recognised that even within the raised domestic area, there exists another distinction, separating the bedroom from other spaces. In this respect, it can be said that, in Thai houses, there is no simple and strong ‘raised versus earthen’ distinction as in Korean houses.

The raised floor of maru and ondol originated from a functional need to endure the hot summer and cold winter, but gradually a strong conceptual dichotomy has been formulated: “the high-level raised clean internal sacred space” versus “the low-level earthen dirty outside secular space”. This attitude that the raised space should be kept away from pollution and therefore wearing shoes in this zone is regarded as a taboo can be explained in terms of “a relative idea” according to Mary Douglas:

“It is a relative idea. Shoes are not dirty in themselves, but it is dirty to place them on the dining-table; food is not dirty in itself, but it is dirty to leave cooking utensils in the bedroom, or food bespattered on clothing; similarly, bathroom equipment in the drawing room; clothing lying on chairs; out-door things indoors; upstairs things downstairs; under-clothing appearing where over-clothing should be, and so on. In short, our pollution behaviour is the reaction which condemns any object or idea likely to confuse or contradict cherished classifications.” (Douglas 1966, 36-37)

This concept of level distinction is crucial in understanding the Korean domestic space and will be a subject of analysis in chapter 4.

3.1.2 plans of the traditional house

The exact plan configuration of the traditional house before the Joseon dynasty (1392~1919) is not found from the historic documents; only the remaining paintings and drawings indirectly show the limited information about the house. All the old plans known today were mostly built after the middle period of Joseon dynasty – mostly after the 17th century. The plans in Korea show a morphological variety in relation to the geographic regions while most of them possess the structure of both maru and ondol (figure 3.2).

From figure 3.2, it is recognisable that maru (hatched part) is combined with other rooms and a kitchen to make different plan types. Interestingly this variation of plan type directly reflects the regional climatic influence. The one on the top has no maru since the region is the coldest area in the country where the average temperature is under 5°C and thus the architectural consideration for hot summer is not necessary. Going down towards the south, the level of the annual average temperature and rainfall go up and, as a reaction, the portion of maru gets bigger. In all cases, the kitchen is a low-level space with an earthen floor and all the other interior rooms are high-level spaces equipped with maru or ondol. Meanwhile, it should be noted that these plans in the figure are the

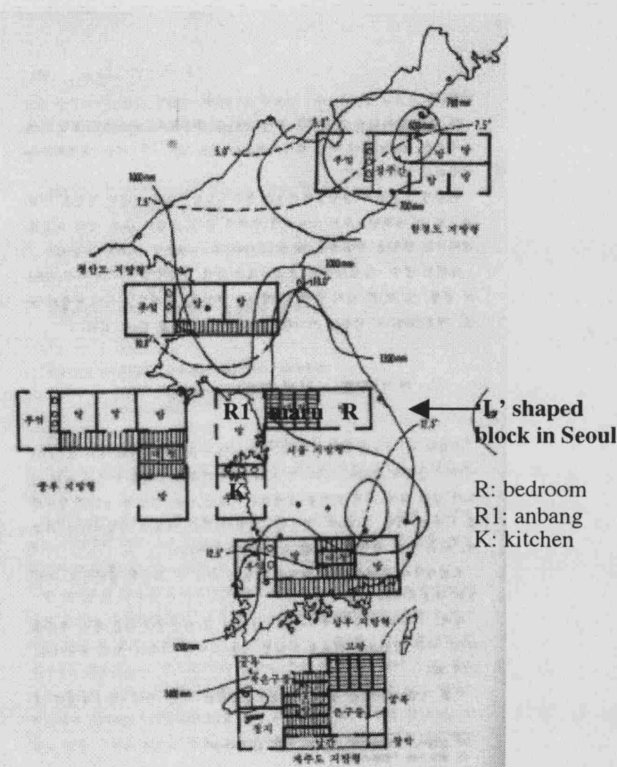


Figure 3.2 Variations of the house plan in the Korean peninsula (Joo 1980, 74)
(curved lines indicate the annual average temperature and rainfall and)

Seoul has been the capital city of Korea since the beginning of the Joseon dynasty (1392~1919). Therefore, for more than 600 years, it has been the centre of Korean culture. This is the reason why this thesis takes the city as a target area for analysis. Geographically, it is located in the middle of the peninsula, so has a mid-range of temperature and rainfall. Consequently, the houses in Seoul retain the characteristics of the north and the south at the same time and hence best represent the housing culture of the country. As can be seen in figure 3.2, the house plan in Seoul has a typical ‘L’ shaped block. The scale of the house varies in relation to the house owner’s wealth and

status, but the basic structure of this 'L' shaped block appears regardless of its scale (figure 3.3).

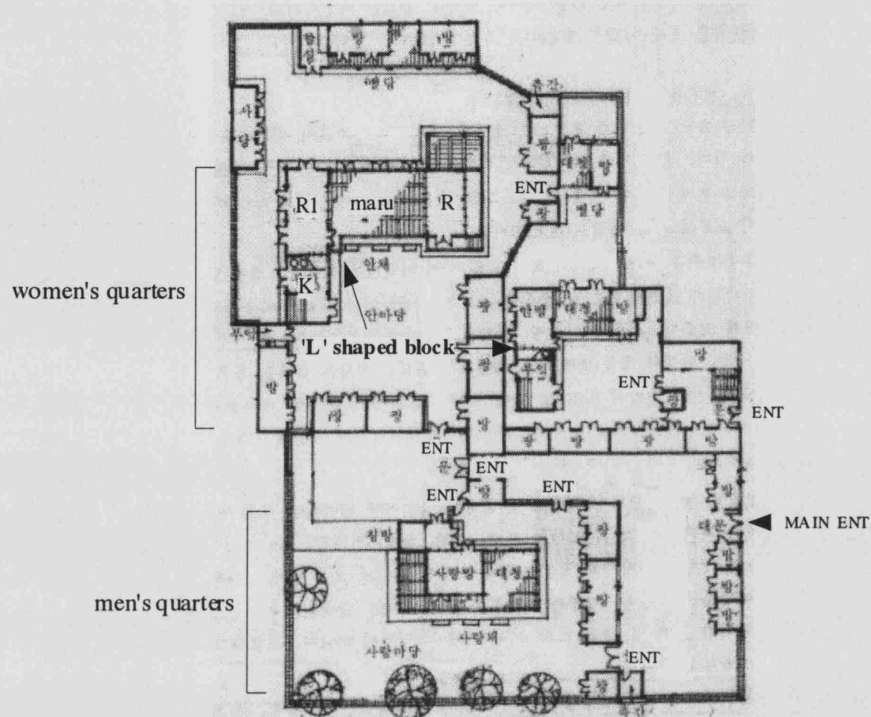


Figure 3.3 A high class house in Seoul, 19th century (reproduced from Joo 1980, 122)
(R: bedroom, R1: anbang, K: kitchen)

Figure 3.3 shows a big high class house built in the 19th century. Although the overall scale is much bigger than the middle class or lower class houses, the 'L' shaped block is still used as a basic unit for the planning. Following Confucian philosophy, the 'L' shaped block in the women's quarters should be allocated father away from the main entrance from the visitor's point of view as in figure 3.3.

In the 'L' shaped block, an *anbang* (a housewife's room; see R1 in figure 3.3) is located in the pivotal point. Two supporting spaces are attached to this best room; a *maru* on the east (or in some cases on the west) as an alternative space for summer and a kitchen on the south to supply heat to the anbang's floor. In the traditional sense, the anbang is a place for a housewife where everyday living, eating, sleeping, working, and sometimes even body washing is done. Men's entrance to this room is strictly limited due to the Confucian philosophy in Joseon dynasty; instead a husband can have a room called *sarangbang* (a husband's room) in a different quarter in this type of big house or, in the case of a smaller house, in a different building in the same quarter. On the opposite side

of the anbang, across the maru, is a *geonneonbang* (literally, the opposite side room) where an eldest son's wife lives. The occupiers of the anbang and the geonneonbang switch their positions when the eldest son's wife succeeds to the status of a housewife (Joo 1980, 53; Kang 1992, 205).

Maru is the space which has been conceptualised as a high and sacred space. It has been reported that the word, maru, was used to describe a government building or a high court, which was thought to be a holy place, and the king of the Silla dynasty (A.D. 4C~7C) was called *maripgan* because he governed his kingdom at the maru (Kang 1992, 215). Even in modern days, this word is used to indicate a high place or position; for example, the ridge of a mountain is still called maru. In the traditional house, it is believed that, amongst many Gods protecting the house, the head God governing the whole house inhabits the maru. For this reason, the maru was thought to be the centre of the house and many ritual ceremonies were held here.

As will be seen in chapters 4 and 5 when house configurations are analysed, the morphology of the 'L' shaped block suggests very important clues in finding the hidden design logic of the modern houses in Seoul. The traditional logic in allocating the anbang in the house is that it should be deeper. Although it is not topologically deeper than the geonneonbang (the opposite side room), it is always geometrically concealed behind the kitchen and the maru and grounded on the deeper corner of the site. The maru, on the other hand, is affected by the traditional planning logic that it should be in the centre. Although it cannot be regarded as central in this 'L' shaped geometry, it is the symmetrical centre of the raised space, with one ondol room on each side. This symbolic concept of space allocation has ^{become?} become a strong convention in Seoul for hundreds of years and therefore is naturally transmitted to the modern house.

3.2 Development of modern houses

It was outlined in chapter 1 that, before the advent of apartment housing, there appeared three housing types that influenced the modernisation process of the housing culture in Seoul. They are: first, the urban traditional houses which were built by speculative builders from around the 1930s until the 60s; second, the colonial houses built by the

Japanese colonial government³ from 1941 until the independence of Korea in 1945; and third, the public detached houses built by the Korean National Housing Corporation (KNHC)⁴ and other organisations after the Korean war (1950-53) until the middle of the 1960s (figure 3.4). Presumably, it was from the morphological information of these houses that the designers of the apartment house, consciously or unconsciously, found reference. In this section, following the historical background described in chapter 1, the architectural characteristics of these houses are described. Figure 3.4 shows the chronological relationship between these three housing types and apartment housing.

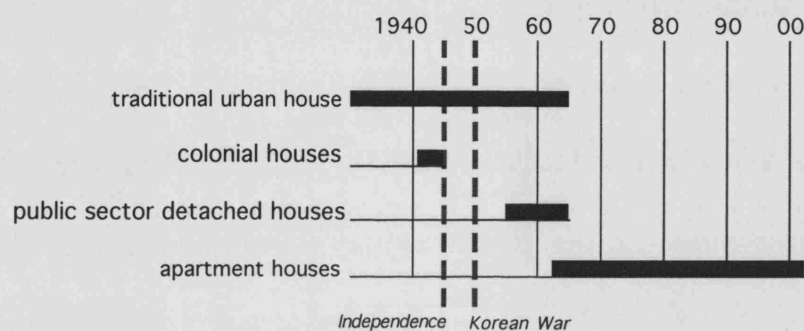


Figure 3.4 Four types of housing in Seoul with their period of appearance

3.2.1 The urban traditional house (1930s ~ 60s)

From the 1920s, the population in Seoul started to grow faster; as the industrialisation process accelerated in this period, more people moved into the city to find jobs.⁵ As the city workers' demand for housing grew accordingly, there emerged an urbanised type of traditional house. It was a compact form of the traditional house within a small plot, which was developed by speculative developers from around the 1930s to the 1960s (figure 3.5).

³ This housing project was executed by 'Joseon Jutae Yeuongdan', an institute set up by the colonial government.

⁴ The exact name of the corporation in this period was 'Daehan Jutae Yeuongdan' which succeeded 'Joseon Jutae Yeuongdan' of the colonial government, mentioned in the previous footnote. This Daehan Jutae Yeuongdan later changed its name to Daehan Jutae Gongsa (the Korea National Housing Corporation). In this thesis, this latest name, KNHC (Korea National Housing Corporation) will be used throughout the period of the Republic of Korea.

⁵ A part of the reason for this population growth in the city is the colonial government's confiscation policy for the agricultural field in the rural area. As farmers lost their land, they moved to the city to find new jobs.

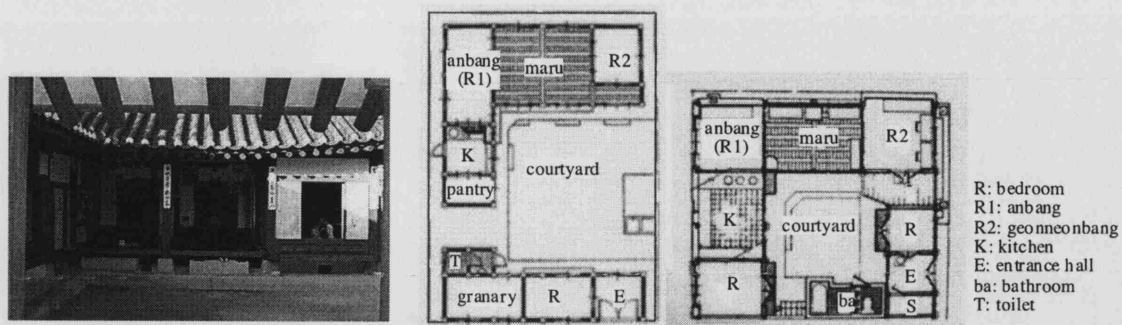


Figure 3.5 Urban traditional houses (left: the maru seen from the courtyard; middle: a plan from Lee 1971; right: a plan from Song 1990)

From the plans in figure 3.5, it is found that the plot fence is tightly surrounding the houses. In this compact format, the central courtyard becomes the only outdoor space. The plan in the middle, recorded in 1971, seems to be older than the other one; this plan has older features like a pantry and a granary. In contrast, the plan on the right, recorded in 1990, has newer features like a modernised bathroom, and it is assumed that the old pantry next to the kitchen has been converted to a bedroom. Interestingly, the time difference between the two document sources – 1971 and 1990 – is naturally reflected in their plans. Apart from these functional and technological changes reflected in the plans, when their spatial configurations are compared, it can be recognised that the ‘L’ shaped pattern of the key spaces is embedded in both houses.

As the urban traditional houses try to transplant the old domestic life into their compact form, it is expected that the old social relationship between inhabitants, which was embodied in a bigger architectural space before, should be compressed and rearranged. Therefore, it seems a natural transition that the anbang, which used to be a sleeping space for a house wife and a living space for women, starts to change its function to become a sleeping space for parents and a living space for the whole family. It is probable that this change in social relationships in the domestic space happened in parallel to the disintegration of Confucian principles under the impact of the industrialisation process, according to which efficiency rather than propriety is more emphasised.

The urban traditional house was a new housing type at the time it was built. This house, however, could successfully preserve most of the essential spatial characteristics of the past in its simplified format and therefore effectively crystallised the spatial genotype

that has been formulated for hundreds of years in Seoul. As will be revealed in chapter 4 and 5, even though it gradually became extinct after the 60s, the urban traditional house played an important role in transmitting the traditional housing culture to modern houses.

3.2.2 Colonial houses (1941~ 45)

The housing deficiency in Seoul became a serious problem by the 1940s as the population continuously increased; the number of households in 1944 grew three times from that of 1925 – from 67,530 to 220,938 (Kang 1992, 100-101). The Japanese colonial government, to deal with this problem, established Joseon Jutae Yeoungdan (Housing Institute of Joseon) in 1941. They initially set up a plan to build 5,000 homes every year until 1945 to supply a total of 20,000, but ended up with the construction of 12,184 homes (re-quoted from Kang et al. 1999, 334). To maximise the productivity of construction, they provided five standard types of plans (figure 3.6). Most of the houses were constructed based on these standard plans.

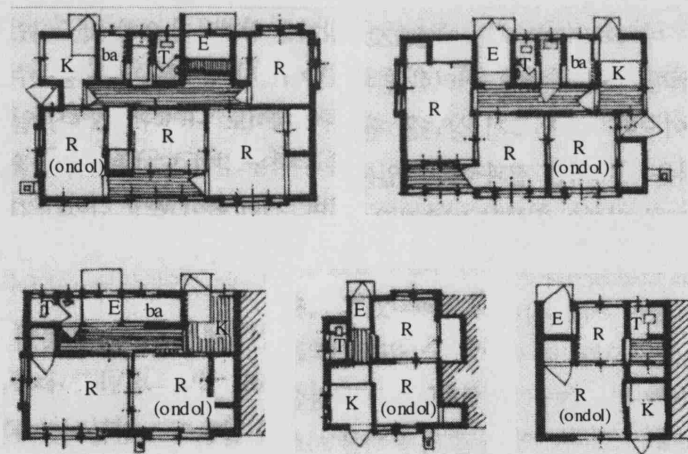


Figure 3.6 Five standard types of colonial housing (from Kang 1992, 103)

These houses were the first generation of modern housing which are completely different from the traditional type of houses, and moreover, the development was the first mass construction of housing by the government authority. Therefore, it can be expected that these plans made a big impact on subsequent modern housing planning. Indeed, as will be discussed in the next section, the planning logic of 'two-row arrangement with a

circulation zone in the middle' in these houses seems to have been transmitted to the next generations of modern houses including the apartment houses.

Investigating these plans, however, it is found that they have many features that originate from the Japanese housing culture. Excluding one ondol room from each plan, all the other bedrooms are finished with a Japanese tatami floor. The sliding doors replacing partition walls between the bedrooms and the way of using a wooden floor for the central corridor and the outer veranda, not for the maru, also resemble the Japanese plan pattern. The only thing that shows a Korean traditional motif is one ondol room in each plan; for this, it is recognised that a kitchen is planned adjacent to it to provide heat.

In brief, the colonial houses were planned without any intention to inherit Korean housing traditions. Rather, they simply transplanted a Japanese modern housing style with minor modifications. Consequently, this radical experiment was not easily absorbed to the Korean housing culture; in the following periods, most of the Japanese features mentioned above are abandoned, and only the overall layout pattern – the double-row layout with a central circulation zone – is adopted for the planning of the modern detached house.

3.2.3 Public sector detached houses (1954 ~ 60s)

After the Korean War (1950-53), it was urgent to build houses to meet the exploding demand in the city.⁶ There were two major institutions that supported the housing construction. The first is KNHC (Korea National Housing Corporation) that succeeded the former Joseon Juteak Yeoungdan of the colonial government. The second is ICA (International Cooperation Administration) established after the War with foreign financial assistance. These two institutions not only financially supported the housing construction but also developed a number of standardised house plans to facilitate it (figure 3.7).

⁶ During the Korean War, it is recorded that 596,000 houses, which amount to 1/5 of the total housing stock, were demolished. Until 1956, Korean government was directly involved in the construction, producing approximately 100,000 houses, but from 1957, it stopped the direct action and tried to assist public sector institutions like KNHC and ICA (Kang et al. 1999, 33-34).

It can be easily assumed that the designers of these plans had no experience and thus no solid idea in designing a new type of domestic space that would successfully accommodate the Korean dwellers' indigenous living style. What is worse, their available references were limited to a few precedents, i.e., the traditional house, the colonial houses, and a small number of western style houses. Considering these unfavourable conditions, it is understandable that their solutions had no consistent design logic; in terms of plan morphology, the plans generated by these planners encompassed many different types of layout – the plans were experimental rather than exemplary.

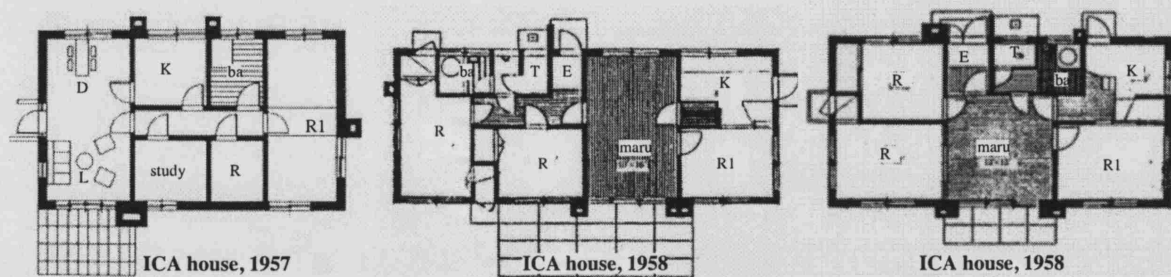


Figure 3.7 ICA house plans in the late 50s
(R1: the main bedroom which is the modern counterpart of the old anbang)

Figure 3.7 shows three different types of house plans designed by the ICA planners in the late 50s. The one on the left is a hybrid of the colonial house and a western style house; it uses the central circulation corridor within the two-row layout just as in the colonial house, and provides an integrated living-dining space which is filled with western style furniture. In this plan, more importantly, maru, one of the most representative characteristics of the traditional house, is missing. Put simply, the planners of this plan copied foreign styles and put them together without knowing the consequences. The plan in the middle shows an unusual combination of the colonial style and the traditional style. As in the previous case, it has a central circulation corridor for the left half of the plan, but when the right half is seen together with the bedroom in the middle, it is recognised that the traditional adjacency link in the 'L' shaped block – “kitchen-anbang-maru-geonneonbang” – is alive.

In the third plan, which is on the far right, the original form of the 'L' shape is more effectively adapted as it has the same three bays as in the traditional house. Moreover, now it has the same old access relations of the maru and the two bedrooms. In this

modern rectangular format, the maru is expanded towards the north and more subservient rooms are directly attached to it without the intervention of the courtyard. Interestingly, even in this situation where most of the rooms are topologically just one step away from the central maru, the designers tried to distinguish the anbang's status by putting the entrance hall in a geometrically farther position from it. In this way, as in the traditional house, the anbang is felt as the deepest space from the visitors' point of view and this pattern is found in the majority of the public sector houses. In sum, it can be said that, in this plan, the symbolic concept of space allocation in the traditional house, i.e., anbang's deeper position and maru's central position, has been successfully transplanted.

Looking at these various types of early modern detached houses in the public sector, a question arises: amongst these plans developed after the Korean War, which type could be more appealing to the dwellers in Seoul? Is it the plan that preserved the traditional morphological heritage, or the foreign style plan which many designers thought to be suitable for the modern style of living? Since the government's target public housing type was changed from detached houses to apartment houses from the 60s, it is only from the private sector that the answer to this question can be derived.

In his typological study, Yim (1988) examined 585 modern detached houses in the private sector built in Seoul from 1964 until 1985. The aim of his study was to "define the characteristics of cultural traditions which might be embedded in urban dwellings" (Yim 1988, 228). Amongst his findings, two design trends he observed can give answers to the above questions. First, he pointed out a tendency where the position of an anbang is decided in a farthest south position from the main gate of the house and also from the entrance hall (Yim 1988, 107). Second, in the modern detached houses, a maru replaces the function of the old courtyard by covering an extended area, and as a result, most of the rooms surround this space (ibid. 107). His observation testifies that the traditional pattern of spatial arrangement has been selected and survived. It can be concluded that, at least within private sector detached houses, the two characteristics of the 'L' shaped block, which are the deeper position of the anbang and the central position of the maru, are still manifest.

From what has been described in this section, it can be generalised that during the early period of modern detached house construction (1954~60s), the public sector designers

suggested many different types of modern plans, and in the following periods where the private sector dominated the detached house market (1964~85), the suppliers and consumers have reached the conclusion that it is better to embed traditional spatial patterns in the modern layout. Now it is necessary to examine whether the apartment house plans would show a similar tendency or a different design approach. It is believed that the investigation of this dominant type of dwelling in Seoul would lead to a more general and objective conclusion in estimating the morphological transition of the houses in Seoul in the 20th century.

3.3 Apartment houses in Seoul (1962~present)

What has become the most prominent feature in the landscape of Seoul in the second half of the last century is the fast-growing number of apartment houses. In the year 2000, there were already more than one million apartment units in the city, accommodating more than a third of the citizens. The history of apartment housing symbolises the modernisation process of the city that began after the Korean War in 1950. It is reported that the first apartment building in Seoul was built in 1958, and the first apartment housing scheme with a site-planning concept was initiated by KNHC (the Korea National Housing Corporation) in 1962. From then on, public sector housing construction was dominated solely by this multi-unit housing type. Figure 3.8 shows how the proportion of apartment housing in the new house construction market in metropolitan Seoul increases at an unparalleled speed in each period (see the growing ratio of the black coloured area as time passes).

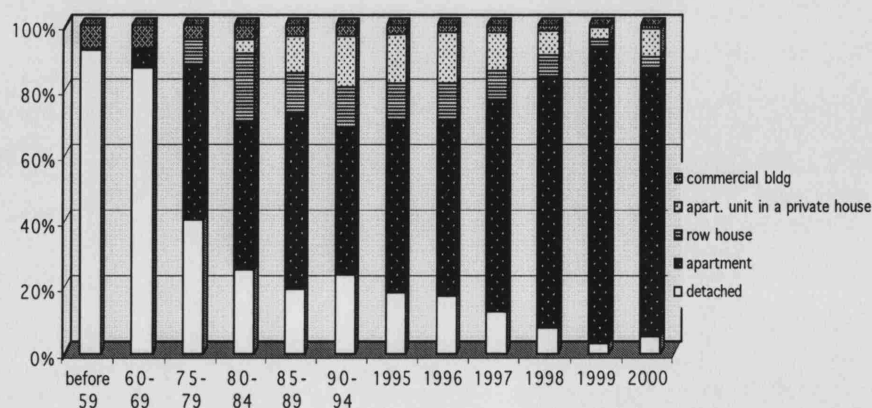


Figure 3.8 The transition of the ratio of each house type in the new housing construction (before 1959~2000; from the Housing Bureau of Seoul Metropolitan Government; <http://housing.seoul.go.kr>)

Between 1975 and 1979, this housing type began to take the lead in the market by occupying 47% of the new housing construction in Seoul, and the ratio kept growing to reach 90% in 1999. In the year 2000, it occupied 51% of the total housing stock in the city. After only a few decades from its first construction, it became the dominant housing type in the city.

One peculiar trait of the Korean apartment housing is that only a few prototypes are repeatedly used throughout its design process: the planning of the unit, the block, and the site, all follow a limited number of patterns. As for the unit, most of the units are single story flats without an internal stairway; the maisonette type is hardly ever found.⁷ More interestingly, it is the two dominant access types, i.e., the balcony access type and the staircase access type that determine not only the building shape but also the basic morphology of each unit (figure 3.9).

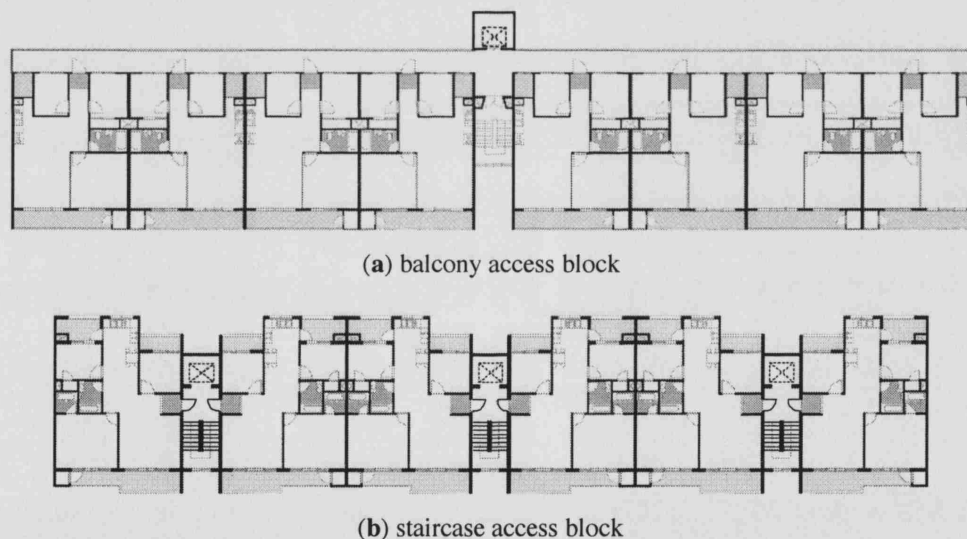


Figure 3.9 Two dominant apartment block types in Seoul

To access each unit, the typical balcony access type put a long public external balcony on each floor, and the staircase access type directly relies on staircases. In either case, public staircases are placed internally, inside the building envelope, so as to avoid prominent projection. Elevators, if needed, tend to be placed internally as well, but in the

⁷ It has been argued that the reason for this is due to the consumer's preference for a 'spacious feeling' by securing a wider internal view (Kang et al., 1999, pp.342-346). By placing the public rooms, i.e., the living room and the dining kitchen, in the central position without partition walls, it is certain that the plan looks more 'open'.

case of balcony access blocks they are often placed externally as in figure 3.9(a) in order to make a simple and direct connection with the access balconies.

Based on these two access patterns, symmetrical pairs of units are attached side by side to generate a thin and long block plan; it is very rare that a block has a mixture of different unit types in it. This typical way of composition makes every unit in the building necessarily open to the front and back and blocked by walls on both sides. In Sherwood's definition, they are 'double-oriented units' – more specifically 'open-ended' plans – and in terms of building circulation, the 'multiple vertical access' type supported by stairs and, in high rises, elevators as in figure 3.9 (Sherwood 1978, 6-17).⁸

Amongst the two block types, it was the balcony access type that was adopted for the earliest apartment housing, i.e., Haengchon apartments (1956), Jongam apartments (1958), and Gemyong apartments (1959) (Kang, et al. 1999, 388). The staircase access type, on the other hand, started to appear relatively later in 1964 in some of the blocks at the Mapo apartment housing scheme. This type, however, has quickly replaced the former and became increasingly prevalent from the late 60s on (ibid. 389). It is the natural result that the balcony access type has lost popularity since this type has restrictions in planning the access balcony side.⁹

Meanwhile, when high-rise apartments, which are normally more than ten stories^{ex. 3} high, became the major construction practice from the 70s, the balcony access type again was widely used for the blocks with smaller size units. This is because the number of elevators, which easily occupies a higher proportion of the price of the smaller units, could be significantly reduced by utilising the balcony access pattern. After the 80s, however, since the relative cost of the elevators within the total construction cost declined, there exists a clear trend that more smaller-unit blocks are built on the staircase access pattern, suggesting once again that this access pattern can provide better dwelling conditions (ibid. 393).

⁸ In its vertical section, each building can be defined as a 'single-loaded system' where single units are stacked up, one on top of the other (Sherwood 1978, 6-17).

⁹ The access balcony on one open-end of the unit greatly restricts the plan freedom on that side and also impairs the privacy of the bedrooms that face this public circulation zone.

After decades of repeated construction of these two block types, the thin slab shape became the typical image of apartment housing, and this practice has been severely criticised by many scholars as having created a monotonous built environment throughout the city. Kang et al. argue that this strong bias towards the slab block shape in Korea can be explained by two major ^{factor} reasons (Kang, et al., 1999, p.388). First, in this shape, every unit can equally have the best natural-light condition^s, which is one of the major concerns for the Korean dwellers who have a long-established preference for the south orientation. Second, the linear building shape can facilitate easy and efficient site planning; using this form, rather than a curved or twisted one, it is easier to deal with the building code while achieving a higher density.

blocks were laid out in //
In the earlier schemes, when the blocks are arranged within the site, they are put on the site in parallel conforming to the site condition with an effort to orient them towards the south as much as possible [figure 3.10(a)]. When the high-rise blocks became the major landscape after the middle of the 70s, this typical arrangement began to be changed. According to the building regulations, any two parallel buildings should keep a relevant distance which is proportionate to their height. Consequently, now another set of parallel blocks could be easily placed in a vertical direction between the increased span of the two south-facing buildings, thus enabling a more densely packed block arrangement [figure 3.10(b)]. This lattice arrangement for the high-rise blocks became another typical feature of the apartment housing after the 80s.

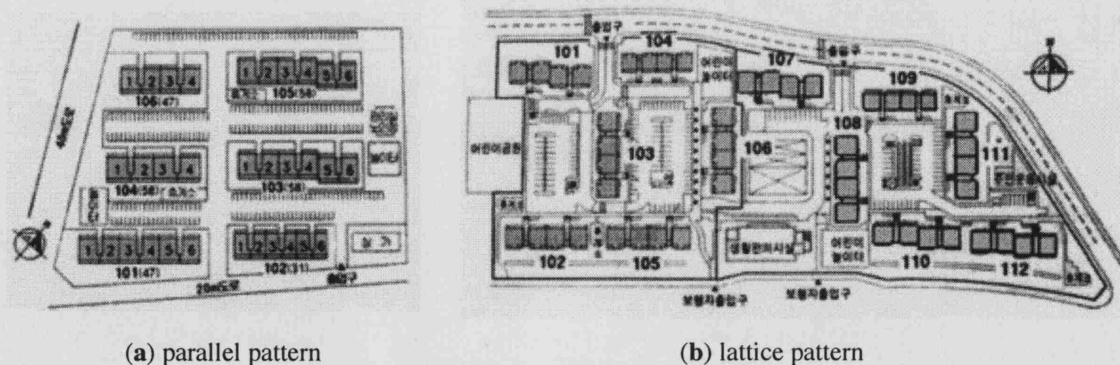


Figure 3.10 Typical block layout pattern

In the earlier period of apartment construction, most of the buildings were less than six stories high, but in the following periods, the number of stories was gradually increased to accommodate more units on limited urban plots. In the case of Gangnam-gu district,

the sample area of this research, after 1977, the majority of the new apartment housing schemes were planned as high-rises that were 12 to 15 stories high (Kang et al., 1999, pp.246-247). In general, buildings in one scheme tend to have the same numbers of stories for the efficiency and easiness of the site planning regardless of the unit types they enclose. If there are blocks with different stories, it is likely that this is deliberately done to provide maximum density by modulating the building heights in relation to the building code. Since the maximum supply of housing has been the main concern for the developers until recently, the efforts to render a more architecturally dynamic and aesthetically pleasing housing scheme was relegated to a secondary issue. Therefore, the mixed development, or other combinatory site development, that aims to offer a variety of dwelling conditions is rarely found in Seoul.

3.4 The target area for research and the sampling method

Seoul, the six hundred years^{old} capital city of Korea, was originally set up on the north side of the Han River. During the twentieth century, its population began to grow faster, thus making the city boundary expand over the suburbs including the southern part of the river. This biggest city in the country, of which the area is 605.53km² as of 2003, has nearly ten million citizens living in twenty-five administrative districts. It was between 1960 and 1990 that the census population has, at an unprecedented pace, multiplied four times (from 2,445,402 to 10,603,250), but from 1990 on, due to the new residential town developments in the vicinity, it has remained steady (National Statistical Office, 2001, www.nso.go.kr)¹⁰.

Gangnam-gu, one of the twenty-five administrative districts, is the sample area for the research (figure 3.11). It has 523,350 people (5.3% of the city) in an area of 39.55 km² (6.5% of the city) and has the second largest apartment stock in Seoul. It has 98,780 units of apartment housing, accounting for 78.1% of the total number of housing in the district and 9.8% of the total apartment units in Seoul. This area, having been a suburban area before, began to be developed along with the boom of the 70s' apartment construction and has been continuously generating new apartment communities. As a

¹⁰ The census population slightly decreased to 9,895,217 in 2000 but is currently going up again yet in a slow pace.

result, it can best represent the city of Seoul with a variety of plan types from the early period until today. Nowon-gu, the district that has the biggest apartment housing stock (14.0% of the city), was not chosen because most of the apartment housing in this area was built after the middle of the 80s.

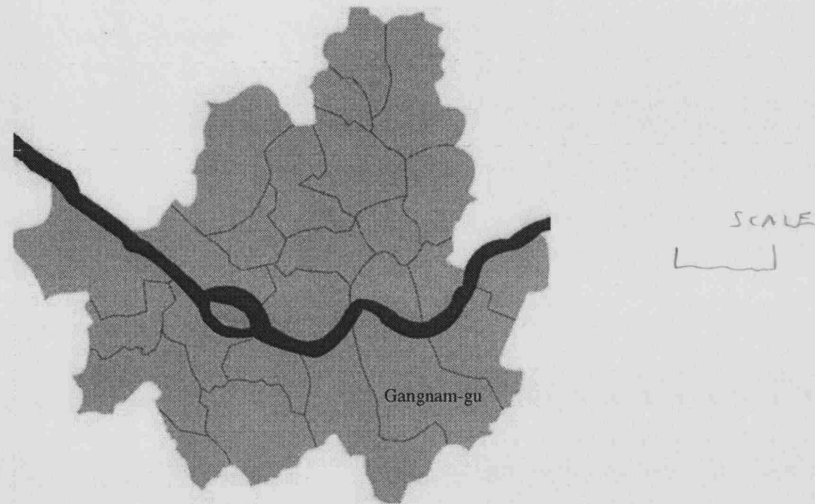


Figure 3.11 Map of Seoul showing the twenty-five administrative districts including Gangnam-gu, the sampling area for this thesis

To narrow down the scope, this study focuses on the three-bedroom plan that is the most common dwelling type in the city. It is based on the fact that the unit plan that has a net floor area of between 80 to 85 m² is the most numerous in Seoul (Kang et al., 1999) and most of the plans close to this size are 3LDK (Kim and Park 1992). In this sampling, all the three-bed plans are included regardless of their size because the research put an emphasis on the topological relation of rooms rather than their geometric size. In this respect, it is aimed that all geometrically different three bedroom plans, both from the balcony access type and the staircase access type, are collected from each apartment housing scheme that has been developed in Gangnam-gu before the year 2000.

The sample plans are collected from second hand data. Currently, the most academically reliable publication that covers the broadest data on the apartment housing plans in Seoul is '*Apateu Baekgwa*' (the Encyclopaedia of Apartment Housing) from Sejinsa press. This book covers most of the apartment plans in the market and has been consistently updated to include new schemes – this research uses the 1990 and 2002 editions.

A total of 132 unit plans were collected from Gangnam-gu. These include the earlier plans that have been already demolished for re-development as well as the existing ones.

From the balcony access type, 57 plans were collected: 14 from the 70s, 29 from the 80s, and 14 from the 90s. From the staircase access type, 75 plans were collected: 11 from the 70s, 30 from the 80s, and 34 from the 90s. It was from the 70s that Gangnam-gu was actively developed as a southern extension of the already over-crowded city, and the apartment housing gained a growing public reputation as an effective real estate investment as well as a convenient dwelling form after it had gone through the 60s' testing in the market.

The year distribution of the sample above already reflects the general trend of the development of the two access types. As mentioned earlier, as the staircase access type has gained more popularity as time passes, the construction rate of the balcony access type has been in gradual decline. The number of the staircase type plans, which was smaller than the balcony type in the 70s, has grown to become more than double the other in the 90s.

Chapter 4

Evolution of the Domestic Space: diachronic space syntax analysis

- 4.1 Introduction: from the old to the new**
- 4.2 Traditional code and its transfer to the early detached houses**
- 4.3 Evolution of apartment house plans: 1960s to 1990s**
- 4.4 Topological paths in evolution**
- 4.5 Level distinction as an underlying force in evolution**
- 4.6 Conclusion: genotypical property of space**

4.1 Introduction: from the old to the new

It was after the Korean War (1950) that the mass construction of the modern-style housing began. In less than a half-century, the house form and culture in the country have been radically transformed. Among the new house types, it was the apartment housing that proved, economically and culturally, to be the fittest in adapting to the middle class need. It is reported that the first apartment building in Seoul was built in 1958, and the first apartment complex developed on a site-planning concept was initiated by KNHC (the Korea National Housing Corporation) in 1963. In the 1990s, after only three decades, it became the most dominant housing type in the city. If it was the traditional central courtyard house that moulded the typical domestic life of Seoul until the 60s, now it is the modern apartment house that takes the prime position (figure 4.1).

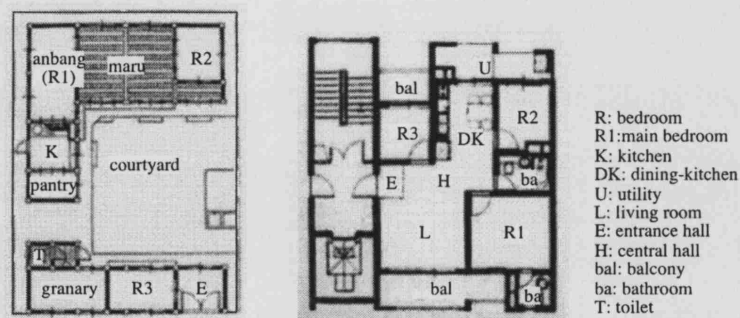


Figure 4.1 Urban traditional house and apartment house
(left plan: from Lee, 1971, right plan: from Kang et al., 1999)

On the surface, morphologically, those two types are completely different. From figure 1, one can see the central courtyard house, which is inward-looking, has now turned into the self-contained modern apartment house, which is outward-looking. What has been changed is not only the overall form. Some spaces like the courtyard have disappeared and some have emerged; those multi-functional rooms like anbang and maru of the old house have been endowed with new names, main bedroom and living room, due to their more specialised functions in the modern period.

This is a situation where the continuity and change cannot be measured simply by the space syntax value of each partitioned space. In other words, for example, the old anbang and the modern main bedroom are not equivalent even though they share a considerable amount of characteristics. To deal with this subtle problem, it is needed to focus on the number necessary

“space-activity” interactions; how the activities in each partitioned space are preserved, migrate, and finally re-group to form new spatial frameworks (figure 4.2).

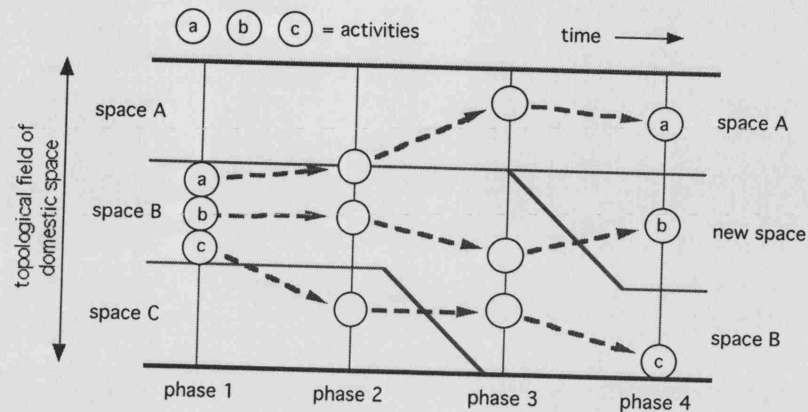


Figure 4.2 Conceptual diagram of “space-activity” interactions

Figure 4.2 shows a conceptual diagram where spaces are interacting with activities within a domestic space. The three activities that belonged together in space B in phase 1 are moving towards different positions as time passes and finally are accommodated in three separate spaces. In the course of their paths, space C demises after phase 2 and a new space emerges in phase 4. If the topological traces of activities that underlie the formal change of domestic space can be illustrated clearly as in the conceptual diagram above, the evolution can be more effectively measured.

Within this conceptual framework that enables the investigation of ‘space-activity’ interactions, the first sub-question of this thesis – *how is an old spatial organisation mapped onto a new setting that is formally and functionally different?* – will be answered. In addition, the results of this investigation will provide a basis for a further analysis that will bring the issue of ‘level-distinction’, and this will answer the second sub-question – *how is an old conceptual dimension in space transferred through a transformation process?*

In the following sections, the movement of activities is drawn graphically in diagrams and then converted mathematically to space syntax values. They are measured at five important stages of evolution, each of which is characterised by an emergence of a distinct housing pattern which are: the traditional courtyard house, the early modern

detached house, the first 3bed apartment house, the typical 3bed apartment house, and the typical 3bed apartment house with a second bathroom. The apartment plans in the last three stages are taken from the staircase access type rather than the balcony access type for the consistency in analysis.¹

4.2 Traditional code and its transfer to the early detached houses

The urban traditional house was developed in Seoul about the 1930s when there was a growing need for city workers' housing (Song, 1980). As outlined in chapter 3, it takes a simplified format of the traditional layout in order to fit into a small and tight urban plot that normally borders one street and three other neighbours. While the layout could vary from one site to another, it typically contains a unique structure that encloses the main functional rooms (figure 4.3).

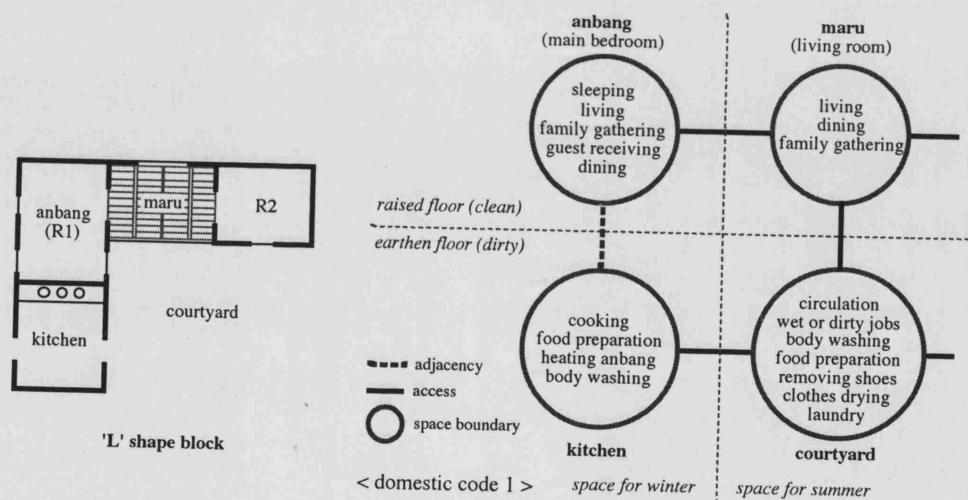


Figure 4.3 'L' shaped block and the domestic code in the urban traditional house

For hundreds of years, this "L" shaped block has been the distinguishing feature of the houses in Seoul (Joo, 1980) and was therefore naturally inherited by the new urbanised house in the early 20th century. Through the repeated production, this structure presumably has been accepted to the people as an ideal arrangement of key spaces. Within the compact layout of the urban traditional house, this "L" shaped block had to be

¹ It is because the layout of unit plans tends to be seriously affected by access types from the initial stage of design. The staircase access type has more flexibility in layout compared to the balcony access type which has an additional limit in planning the access balcony side, thus is believed to reveal more for the understanding of the configurational logic. As fully described in chapter 3 for the rationale, the scope is further limited by focusing on the three-bedroom plan which is statistically the most dominant in Seoul.

placed along the site boundary around the central courtyard as in figure 4.1. As a result, it was the direct link between the block and the courtyard that held the essential space-activity interactions, and this can be put into a domestic code diagram (see the diagram in figure 4.3).

The diagram linking the four main spaces, anbang, maru, a kitchen and a courtyard, can epitomise the spatial characteristics as well as the topology of these spaces. Those two living spaces on top were named after their user (anbang, a wife's room) and construction material (maru, a raised wooden-floor) unlike their modern counterparts, main bedroom and living room, and this may be due to the fact that these rooms could not be associated with particular functions. In the diagram, some representative activities of each space are shown inside the circles.

Rather loosely programmed, these spaces could accommodate various kinds of functions including providing support for the space nearby. The anbang and maru always support each other with living and dining activities, and the kitchen and courtyard, with body washing and food preparation. Since these concurrent activities tended to be scheduled by season, the anbang and the kitchen can be categorised as “winter spaces” and the maru and the courtyard as “summer spaces”.

The kitchen was always directly adjacent to the anbang because the hot air produced from its fireplace, which is also used for cooking, was drawn under the raised floor of the anbang for heating. The maru was also raised to the level of the anbang – several steps' height above the ground – yet with the opposite purpose of passive cooling in summer. These two types of elevated structures were developed solely to control the interior temperature but, through long custom, they encapsulated the conceptual distinction of “raised-clean-living zone” versus “earthen-dirty-subsidary zone”.

This spatial code described above governed the housing culture for centuries with authority but, when the new housing types were introduced from the mid-twentieth century, changes began to be made. Those traditional space-activity relations started interactions to make different combinations in new domestic settings.

Mass construction of economical modern houses began after the Korean War (1950) to

meet the growing demand in many cities across the country. It was the first generation of modern housing development and many standard types of detached house plan were designed by ICA (International Cooperation Administration) and KNHC. Compared with the urban traditional house, the overall morphology of these plans was significantly different in that the courtyard moved out of the central position to surround the houses, which now are mostly double-row structures. On a closer look, however, it is still found that the traditional domestic code is still manifest; the same topological relation of the four essential spaces has survived to preserve the traditional way of living (figure 4.4).

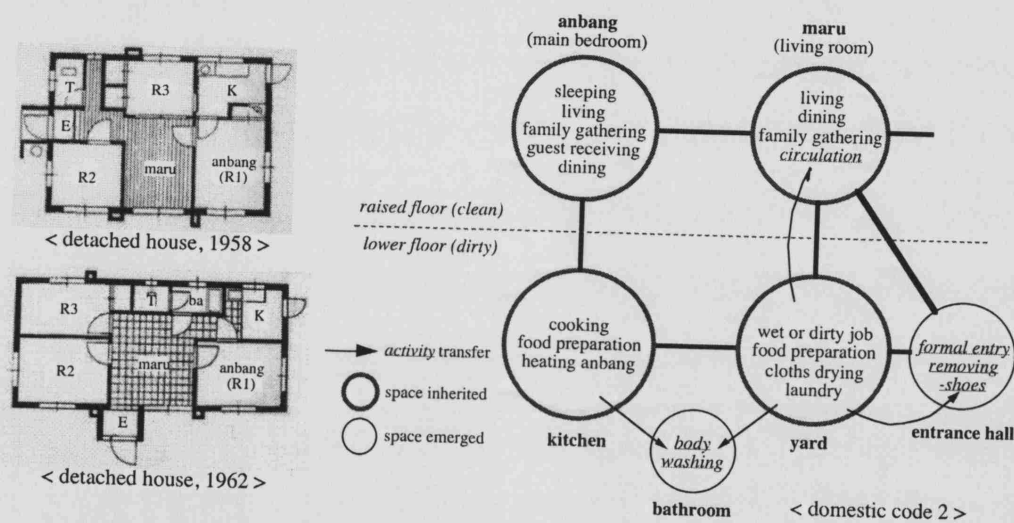


Figure 4.4 Modern detached houses and the domestic code (code 2)
(source: house plans from Kang et al., 1999)

The only change within it is the strengthened link between the anbang and the kitchen; they are now directly accessible from each other for utilitarian purposes. It can be said that ^{the} anbang as a main dining room now takes the stronger role than the other rooms.

While the primary spatial links are maintained, some minor changes have been made. The entrance hall was attached to the maru to mediate the inside and outside, thus taking away from the courtyard the activity of removing shoes. It is interesting to note that this “formalistic depth-increasing” in the shallowest part of the house – to emphasise the rites of “going into the house” – is quite contrasted with the “utilitarian depth-decreasing” between the anbang and the kitchen in the deepest part. Around this time, bathrooms began to be built within some houses, so gradually the activity of body washing slipped out of yards and kitchens.

In this phase of evolution, the maru became the most integrated space taking the function of circulation from the courtyard. Although this central room should allow many through-movements, it could still accommodate many activities as shown in the diagram owing to the traditional floor-sitting style of living. The maru, however, was destined to become a more independent space in the near future to be able to include the growing amount of western style furniture. In this respect, it can be anticipated that the function of circulation would be transferred, again, to another part of the house.

These modern detached houses were the first generation of modernised homes that suggested possible ^{kinds} ways of modern configuration that can enclose the indigenous pattern of living; hence they strongly affected the apartment house plans that followed.

4.3 Evolution of apartment house plans: 1960s to 1990s

After its first mass development in Mapo in 1963, in only three decades apartment housing became the major dwelling type in Seoul. Now there are more than one million apartment units in the city accommodating more than a third of the citizens.² One of the conspicuous characteristics of the apartment houses in Seoul is the existence of a strong pattern in the plans. In their study, Kim and Park found out, from the analysis of almost all apartment house units built between 1962 and 1990 in metropolitan Seoul, that only a small number of plans are adopted “constantly and ubiquitously” (1992). They identified these dominantly prevailing plans in relation to the floor area, construction body (public or private), and the year they appeared. Amongst them, only three bedroom plans were chosen for the purpose of this thesis (figure 4.5).

² Between 1975 and 1979, apartment housing began to take the lead in the market by providing 47% of the new housing construction in Seoul, and the ratio kept growing to reach 90% in 1999. It provided 51% of the housing stock as of 2000 in Seoul (Korea National Statistical Office, 2001).

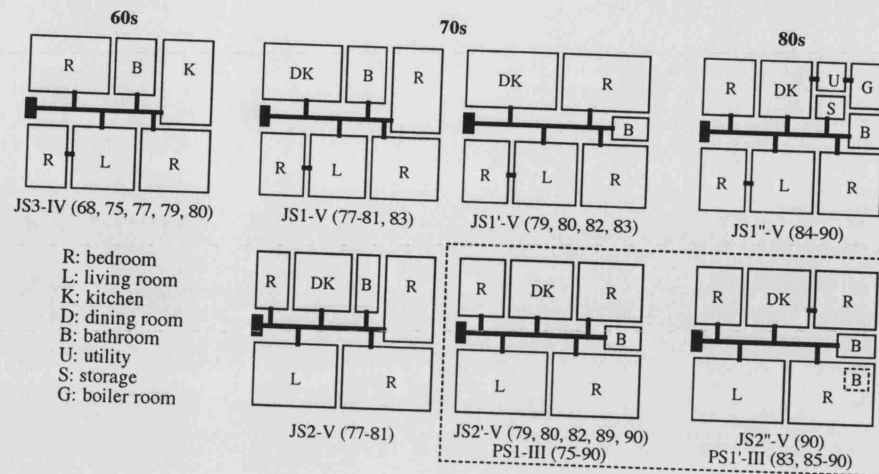


Figure 4.5 Typical 3 bedroom staircase access plans in metropolitan Seoul
(source: reproduced from Kim and Park, 1992)

The labels under each plan are from the authors' sorting method and here it is sufficient to know that the first letters "J" and "P" mean they are from the public sector (KNHC) and the private sector respectively, and the second letter "S" stands for a staircase type. Following the labels are the years they appeared. A visual inspection reveals that it was KNHC that built most of the houses until the early 70s, and tried to develop and test more plans than the private sector. The private sector, in contrast, has only two typical plans, PS1-III and PS1'-III, which are duplicated within the public sector (see the dotted-line box in the figure). Since these two plans were more repeatedly used in both sectors, it can be inferred that they make up a larger proportion of the apartment housing stock than any other types.

The sample plans collected from Gangnam-gu in Seoul can clearly verify what has been described above (see section 3.4 for the sampling method). By taking all geometrically different 3 bedroom plans from each apartment complex, 75 plans have been collected from the area. Amongst them, 21 cases were PS1-III and 22 were PS1'-III, occupying 28% and 29% of the sample respectively; thus, when combined, these two types alone make up overwhelming 57%. What could be also found was the clear division of the construction period by these two types: in the 80s, there were 16 PS1-III and 1 PS1'-III, but in the 90s, reversely, 2 PS1-III and 21 PS1'-III. From the result, it is safe to say that PS1-III and PS1'-III are the two most popular types representing the 80s and the 90s respectively and shaping the typical middle-class home life in Seoul.

All the plans in figure 4.5 have the same circulation pattern, which is another strong feature of the staircase type apartment in Seoul. The entrance hall is always placed at one end of the middle row from which the central circulation hall is extended across the house demarcating the upper and lower zones. In real plans, however, it is often difficult to distinguish this central zone because, in most cases, it is fully open to the living room and the dining-kitchen without partitioning; thus it becomes a part of the fully interconnected public realm (see code 4 in figure 4.6). In this research, for consistency of analysis, this type of circulation zone will be regarded as an independent convex space with a label of central hall.³

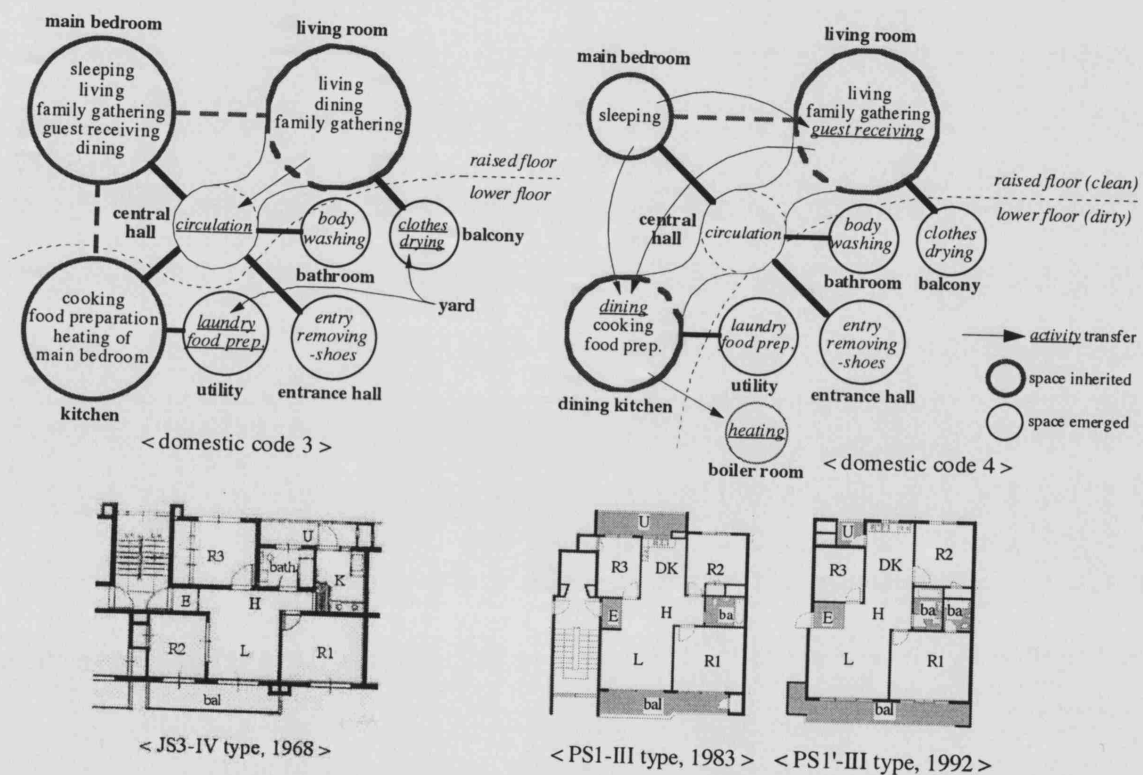


Figure 4.6 Domestic code diagram 3 and 4 with related apartment plans (source: house plans from Kang et al., 1999 and website, www.r119.co.kr)

When the seven plans in figure 4.5 are adapted to the domestic code format, surprisingly, only two types of code emerge (figure 4.6). Code 3 on the left applies only to the earliest

³ When this central circulation hall is seen as a part of a living room, any space syntax analysis dealing with Korean apartment houses would necessarily yield the same result: the living room always becomes the most integrated space. This typical way of analysis, which most of Korean researchers follow, can be misleading because of the following reasons. First, in its framework, researchers fail to find the most important evolutionary link between the apartment house and the colonial house, i.e. a central circulation hall. Second, it blurs the living room's status change through time to become a more independent space by rendering this room an all time circulation core. As will be seen in section 6.3 (see figure 6.1), it is impossible to reveal the compositional logic of apartment houses in Seoul without the existence of the central hall as an independent compositional element. Be it large or small, all the staircase type unit plans are generated first by lengthening or shortening the topological distance of the central hall (see figure 6.2).

plan (JS3-IV) and all the other plans, in spite of their configurational variety, converge onto code 4 on the right.

What makes those two codes different lies mainly in the status of the kitchen. In the earliest 3 bedroom plan, the kitchen still contained the traditional heating function, and for this, its floor was sunken and the main bedroom, which still carried all the important activities until this time, was directly adjacent to it to be best heated (code 3). Because of its lower level, which is always associated with the word “dirty”, the kitchen could not be regarded as a proper place for dining. This problem was solved when a boiler was introduced and placed in a separate space (code 4). Owing to this technological improvement, the kitchen floor could be raised to the level of other living spaces, and this change greatly affected the domestic environment.

For the main bedroom, this was an important moment to break free from its centuries-old connection with the kitchen and turn it into a private space mainly for sleeping.⁴ Owing to this remarkable change in its status, the kitchen becomes the only space that has successfully crossed the conceptual boundary between the “dirty low-level zone” and the “clean high-level zone”. Code 4 further reveals that the kitchen absorbs the dining function and becomes a crucial axis of the public domain. As for the living room, though it has given the dining activity to the kitchen, its public function is much strengthened. Since the main bedroom ceases to be a multi-functional public space, all the parallel functions in the living room are strengthened. In the course of the transition between code 3 and 4, therefore, the role of the *anbang* and the *maru* as two axes of public activities in the past has given way to the living room and the dining-kitchen in the modern apartment houses.

The biggest change at these stages of evolution is the disappearance of the yard that still featured strongly at the time of the earlier detached houses. Of the four essential spaces, now the main bedroom, the kitchen, and the living room are left with more or less changed functions. What is noteworthy here is that the kitchen and the living room, which used to be supported by the yard, are relying on the alternative spaces, the balcony

⁴ These room-activity relations could be controversial in that a type of plan can accommodate a wide spectrum of living styles. Therefore these codes suggest only the general pattern of change in spatial usage in Seoul. For the survey data of space usage in 3 bedroom apartment plans in Seoul, see “Kim and Yoon, 1992”.

and the utility room, in the apartment houses to preserve the activities of the yard.

4.4 Topological paths in evolution

Over-viewing the whole process, some important points can be summarised. The traditional link of the four essential spaces was still preserved in the detached houses of the 50s and 60s, but when it comes to the apartment houses all the relationships are re-arranged, and the yard disappears leaving small fragmented spaces to preserve some of its activities. The only indication that suggests the initial code structure is the adjacency between the main bedroom and the living room, which, like a rule, appears in every typical plan. The central hall emerges as a universal solution for the circulation in the staircase type apartments in Seoul, and it links the three remaining essential spaces. The function of circulation, therefore, has been transposed from the courtyard to the maru, and then to the central hall.

The next four graphs illustrate the topological paths of the activities by means of RRA values (from figure 4.7 to 4.10). Each graph shows the traces of activities that came from one of the four key spaces. Using RRA values which show the degree of integration, precisely how these activities are assigned their topological position in each phase of the housing evolution can be revealed. First, figure 4.7 shows the diachronic movement of the activities that once belonged to the anbang, the counterpart of the modern main bedroom.

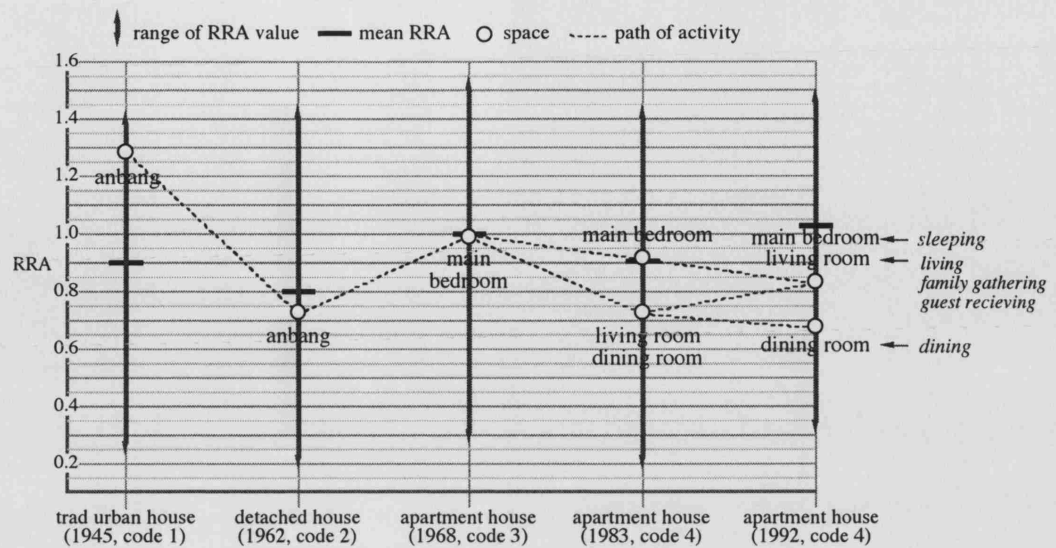


Figure 4.7 Topological paths of the activities of the anbang

The five representative activities in the old anbang change their position in terms of RRA values but remain together in a single room until the third phase of the evolution, i.e. the first three bedroom apartment house of 1968. In the fourth phase, as the kitchen develops into a dining-kitchen, the activity of dining moves from the anbang to the dining room. In this phase, the function of living, family gathering, and guest receiving that used to happen in both the anbang and the living room are more strictly confined to the living room in order to render the anbang a more privatised space for parents.

Through the five phases of the transition, the five activities of the anbang are spread into the three spaces, the main bedroom, the living room, and the dining room. Therefore, through the space-activity interactions, the anbang becomes the most activity-depleted space amongst the four key spaces of domestic code 1 in figure 4.3 and this implies that it lost its traditional meaning as the most important space for the whole family. By looking at the overall transition of RRA values, it can be said that those five activities have migrated from the more segregated part of the house to the more integrated parts as time passes. Hence in the modern apartment houses, they tend to happen in more open and exposed places than before.

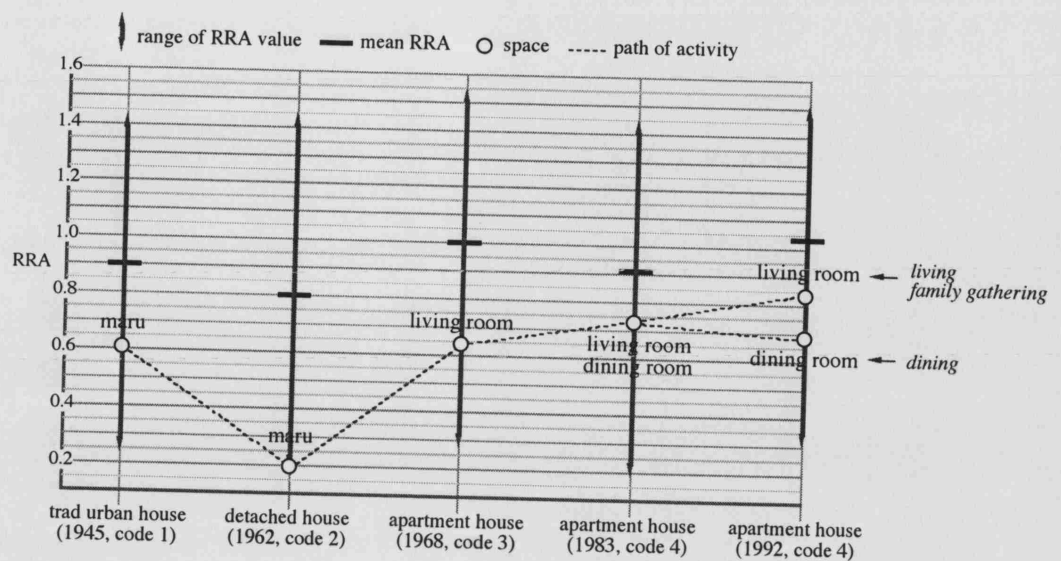


Figure 4.8 Topological paths of the activities of the maru

The old maru in the traditional house was the space for living, family gathering, and dining. All the way through their migration, these activities are kept lower than the mean RRA values, thus positioned in more integrated parts of the house. They move to the lowest level in the second phase when the maru inherits the function of circulation and becomes the most integrated space due to the demise of the central courtyard. The advent of apartment houses has endowed the maru with a new name, the living room, and this implies its status change to a more independent living space furnished with western furniture. The activity of dining is absorbed to the dining room from phase four when the floor level of the room is raised to become a high-level clean space.

In the traditional courtyard house, the kitchen was the space not only for cooking and food preparation but also for body washing in winter and bathing in all seasons. As soon as the modern detached house was equipped with a bathroom, the activity of body washing was separated from the kitchen (figure 4.9). In the last phase of the evolution, the path of this activity bifurcates, as the second bathroom attached to the main bedroom absorbs this activity from the most segregated position. Following the modern trend where the kitchen becomes a pleasant living space for the whole family, the activity of cooking and food preparation moves downwards in the graph to the more integrated central area.

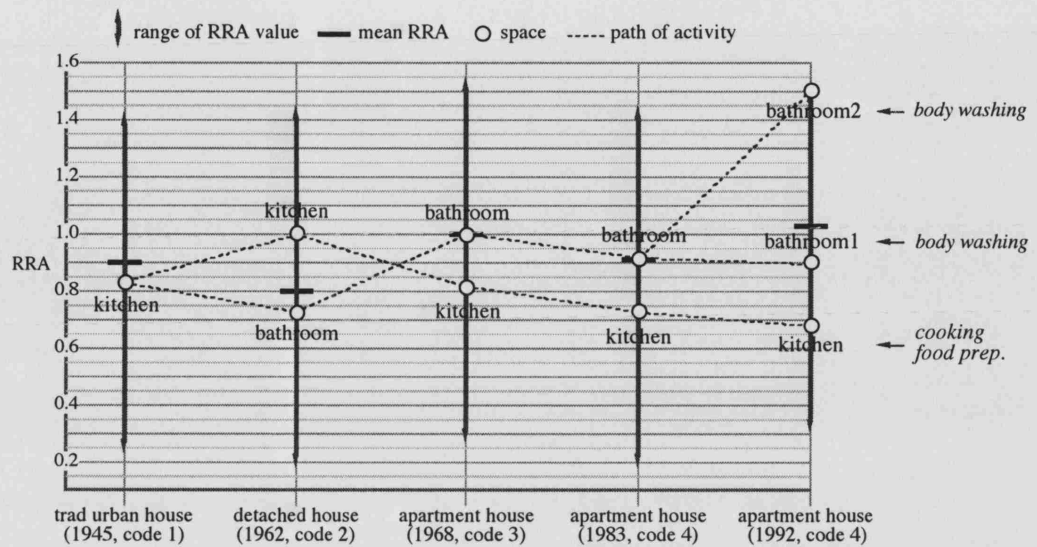


Figure 4.9 Topological paths of the activities of the kitchen

The most startling change of all is the transformation of the courtyard. The multiple role of this outdoor space has been successfully re-distributed into the five newly emerged rooms in the modern apartment house as previously illustrated in the domestic code diagrams. The utility room, the balcony, the entrance hall, and the bathroom have inherited its activities, and the central hall is now supporting its function as a circulation core. Again, this process of “activity relocation” can be better understood when seen through the topological paths graph (figure 4.10).

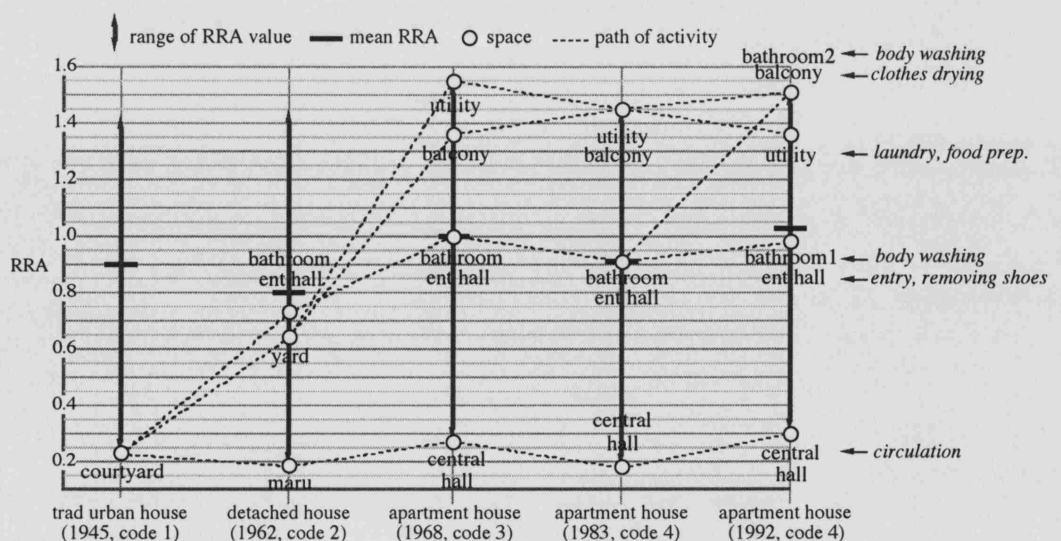


Figure 4.10 Topological paths of the activities of the courtyard

The activities derived from a single space, the courtyard, are migrating through the different routes and spread across the domestic field. It is evident from the graph that the activities that once belonged together in the most integrated space are diverging gradually towards the other end, the most segregated space. In fact, it is a natural result caused by the reversed characteristics of the old and new house configurations. The main substitutes for the central courtyard, i.e., the balcony and the utility, are destined to be placed on the perimeter in apartment houses, and this location is likely to have higher RRA values.

4.5 Level distinction as an underlying force in evolution

Interestingly, what has been transferred from the courtyard is not just the activities it enclosed but its structural concept – namely, “the lower level of the yard”. Except for the central hall that succeeds only the positional role of the courtyard as a circulation core, those new alternative spaces have all inherited the low-level that has to be separated from the clean living zone of the upper level – though the level difference has been reduced to a few centimetres. Therefore, it is found from the four phases of the domestic code diagrams that the “raised versus lower” distinction keeps operating all the way through (figure 4.11). It is an irony that the lifted floor of the traditional house, which was originally designed for cooling and heating, is still alive in the modern apartment houses. The initial function is now totally lost but the secondary function, the clean-dirty distinction that was “acquired” through long practice, has been transferred to the modern homes.

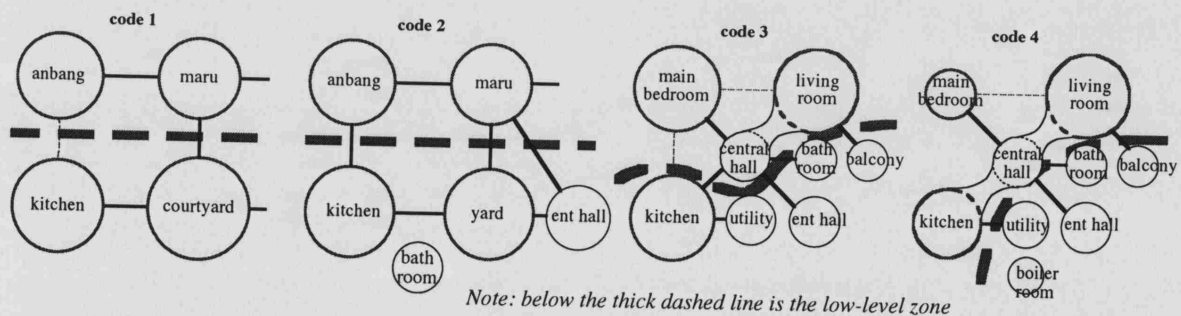


Figure 4.11 Transition of the boundary between the high-level and low-level zones

From the fact that the level distinction has survived the transformation process of the

yard, a possibility arises that this line of thought can be expanded to the domestic space as a whole. If this conceptual dimension has acted as an underlying force to affect the evolution process, then, is it also possible to detect its paths that follow certain directions? This assumption can be investigated first by relying on the most fundamental method of space syntax, the justified graph (figure 4.12).

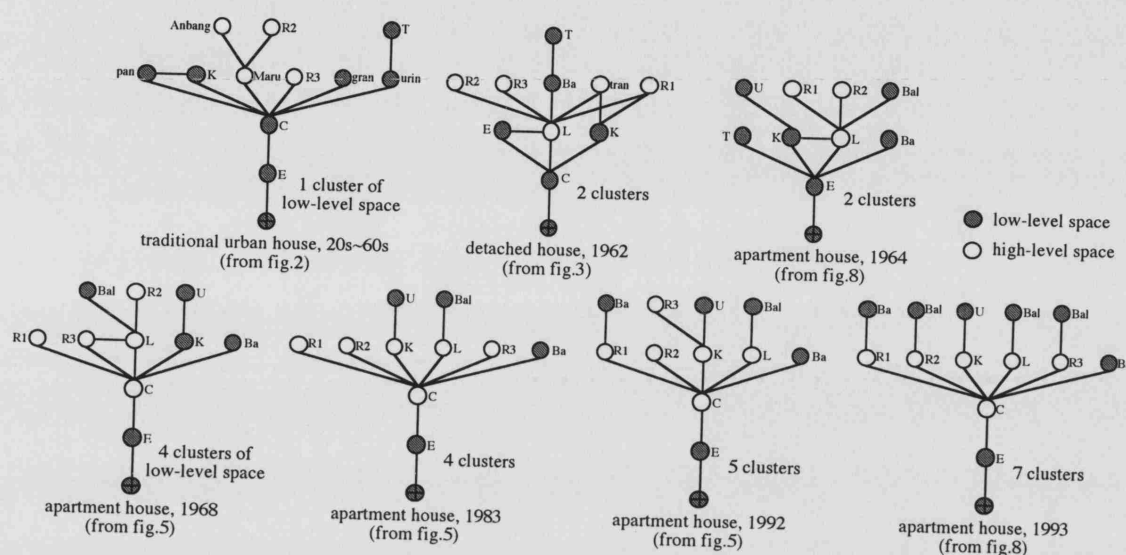


Figure 4.12 Justified graphs of the houses in Seoul from 1930s to 1990s

In figure 4.12, the five house plans from the previous figures are converted into the justified graph format with the dark dots representing lower-level spaces and the white dots raised spaces. Two more graphs were added on the far right side of each row; they are from figure 4.13 to represent the earliest staircase type unit (1964) and the 90s' new two-bathroom type.⁵

In the first graph of the urban traditional house, the courtyard ("c" in the graph) is placed in the centre and binds all the low-level spaces together in one cluster, which means that one can move from one lower-level space to another without removing shoes. The next graph represents the detached house of 1962 with two clusters of dark dots. In this self-contained house, the bathroom and the toilet form an isolated cluster where extra pairs of slippers exclusively for this separate lower dirty zone are worn. The first staircase type

⁵ The 1964 plan is included notwithstanding that it has only two bedrooms because it can give us a clue to what the designers of this earliest plan had in mind – we cannot find 3 bedroom plans until 1968. The 90s' new type can be defined by its three bays in the south and two bathrooms which are detached from each other within the unit.

plan of 1964 also maintains, with a different arrangement, the two clusters. Considering the configurational restrictions in apartment unit design, however, this earliest attempt to group the six low-level spaces in one cluster seems quite intentional, and therefore could be interpreted as a conscious effort to separate the two zones.

The two graphs for the 1968 and 1983 apartment houses have four clusters of dark dots. The difference between them lies in the kitchen's changing status to a high-level space in the later plan as has already been noted. As a result, after the 1968 graph, no more multi-space clusters appear and only the singular cells of sunken rooms are scattered across the houses.

What should be pointed out in the last three graphs, from the 1983 plan to the 1993 plan, is the on-going trend of cluster-increasing; this has resulted from the extra bathroom in the 1992 plan and the two more balconies in the 1993 plan. This exactly reflects the general trend of unit planning in Seoul which has been pointed out by many researchers; the two-bathroom plan, PS1'-III, becomes dominant in the 90s, and the number of balconies are constantly growing from the 70s on to cover the whole perimeter zone in the late 90s (Choi, 1996, Kang et al., 1999).

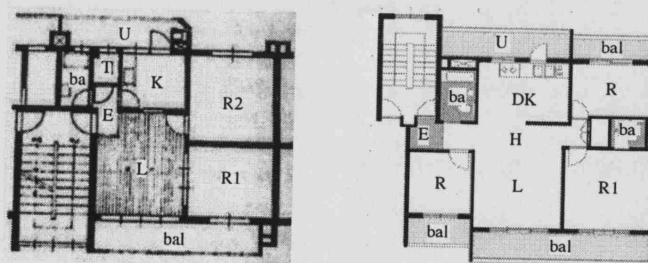


Figure 4.13 Earliest staircase type plan (1964) and the new two-bathroom plan (1993)
(source: Kang et al., 1999, website, www.r119.co.kr)

Looking at those seven graphs together, some transitional patterns can be easily recognised. The number of clusters is increasing while the number of spaces in each cluster is decreasing. In the urban traditional house, the low-level spaces are all connected from the shallowest part to the deepest part of the graph, but from the detached house, those spaces in the deepest part begin to be separated, making another cluster. The number of isolated clusters on the top edge of the trees is getting bigger through time, and finally all of the end spaces in the last graph are occupied by the low-level spaces. In a sense, it is as if all the dark dots have been gradually decentralised by a

centrifugal force while the white dots have converged into the central area – the two contrasted spaces are moving towards two opposite directions. If the first and last house plans are directly compared again (see figure 4.1), it can be realised that this is the necessary procedure for the traditional housing to arrive at the totally reversed form of the modern apartment configuration.

Now it is possible to convert these justified graphs to RRA values (figure 4.14). In the graph, the dark dots represent the mean RRA of low-level spaces and the white dots that of high-level spaces. As expected from the justified graph, the mean RRA of low-level spaces in the urban traditional house is lower than that of high-level spaces. In the detached house, this order is reversed as the maru replaces the courtyard by becoming the most integrating space in the house. Starting from the first apartment house in 1964, the two heterogeneous RRA values are gradually diverging from each other while the mean RRA values are maintained with small changes.⁶ This bipolarisation exactly reflects what has been observed from the justified graphs. The high-level living spaces are centralised around the central hall, and more low-level subsidiary spaces are placed on the outer edge to surround the unit.

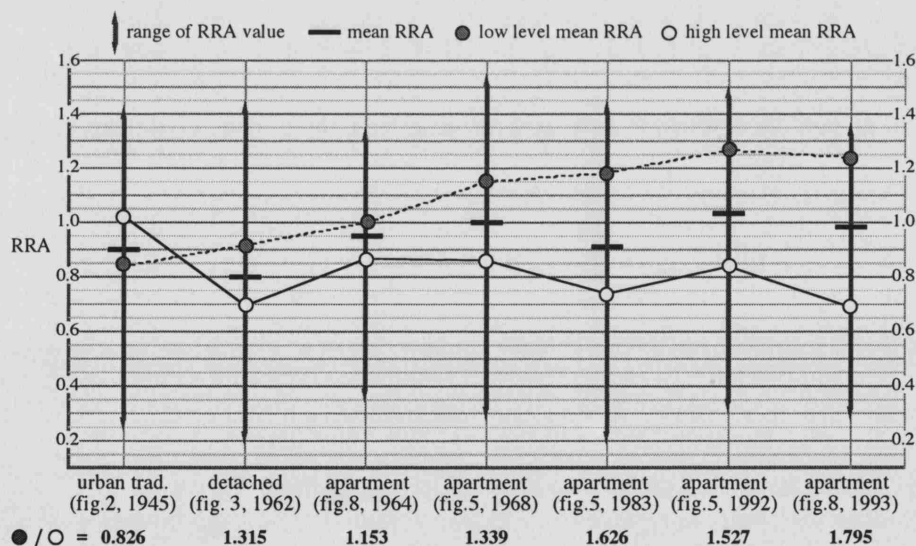


Figure 4.14 Transition of the mean RRA of lower and higher level spaces

The value right below each house label can show this trend more clearly. This value is

⁶ While the two heterogeneous spaces are getting more differentiated, the mean integration values of the apartment houses stay in a certain range; they are moving between 1.028 and 0.909. It is mainly due to the existence of the central hall that tightly binds up spaces together symmetrically from the middle without allowing the asymmetrically long sequence of rooms.

gained by dividing the mean RRA of low-level rooms by that of high-level rooms. It is a useful way to further “relativise” the difference between the high and low spaces within a system for better comparisons with others. The increment in the value means that the low-level spaces are getting more segregated, or the high-level spaces more integrated, or both. When this relativised value is applied, the gradually increasing values are found for the apartment houses, which confirms the visual observation of the divergence in the graph; each category of space is moving to the opposite direction, thus getting more differentiated. The only exception is the 1992 house of which the value is lower than that of the previous 1983 house. It is found by inspection that this decrease in the value is due to the following reason. The second bathroom in the 1992 house inevitably blocks the direct access from the central hall to the bedroom in the north, thus causing the alternative access via the kitchen (see its plan in figure 4.6). This has to happen for geometric reasons against the designer’s intention, hence the value again goes up when this problem is solved in the 1993 plan where the second bathroom is placed in the opposite corner.

Now, the same analysis is applied to the 75 sample houses in Gangnam-gu area of Seoul. The purpose of this is to examine whether or not the trend found from the small number of representative plans is also recognisable from the global scale observation. The relativised value, which is obtained by dividing the mean RRA of low spaces by that of high spaces, is again utilised, and the 75 values from the entire plans are plotted on a scattergram (figure 4.15). These sample houses were built between 1974 and 1999, so, chronologically, this graph corresponds to the later period after the 1968 house in the previous graph.

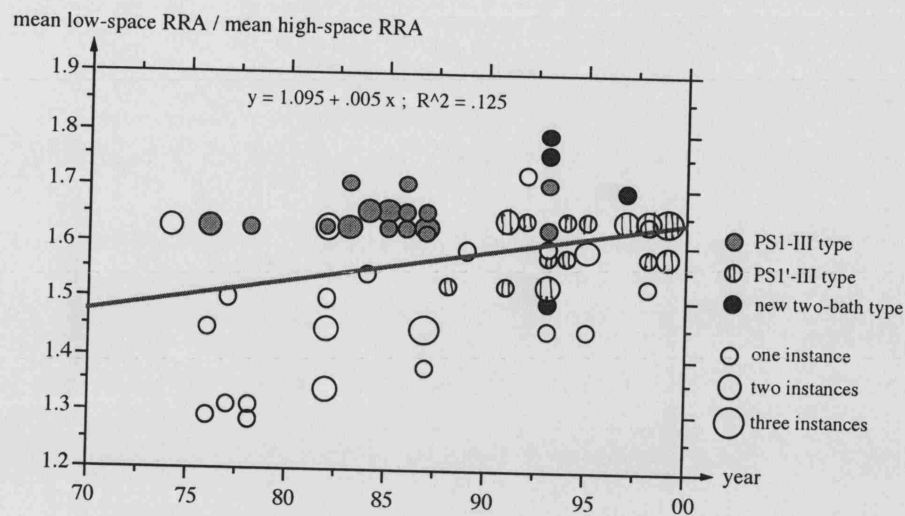


Figure 4.15 Scattergram showing the chronological distribution of the relativised value

The two major types, PS1-III and PS1'-III, and the new two bathroom type – representing the last three phases in figure 4.14 – are shaded so as to be distinguished from the other minor types. The pattern of these three generally matches the trend in figure 4.14: the average value of PS1-III is 1.65, PS1'-III 1.61, and the new two bathroom type 1.69. Whereas this pattern verifies the exceptional value-drop of the 1992 house in figure 4.14, it does not conform to the overall tendency of a gradual rise in the value. In other words, in the light of the major plans, it seems that these last three decades of the housing evolution do not strengthen the argument of this paper that the two heterogeneous spaces are topologically diverging from each other – though the technical reason for this has already been explained.

Now, the hatched dots are seen together with the blank dots, i.e., the minor type plans. From the perspective of the whole sample, two trends emerge. First, the three representative types, in most cases, have higher values than the minor types and their proportion in each period is growing – they thrive as time passes. Second, the minor type plans, in contrast, are decreasing in terms of their proportion of the total, and this happens, interestingly, more intensely for those in the lowest position in the graph – those with the lowest value are gradually becoming extinct. The existence of these two different trends is an important clue that suggests that the direction of evolution is closely related to what the relativised value implies. Syntactically speaking, the “fittest” in the market has been the plan where the high-level main functional rooms were more centrally linked while the low-level rooms were pushed out to the more segregated area.

Therefore, those plans that fit this condition, thus having the higher relativised value, had more chances to survive, and those that did not had fewer chances.

The analysis of the 75 sample plans reveals that, in this last stage of the evolution, the two contrasted topological movement^S of the high and low spaces are still active, and, surprisingly, it is the minor types that reflect this trend to a stronger degree. More importantly, the scattergram suggests a possible explanation of how this pattern of evolution occurs. If the topological differentiation of the low and high-level spaces is the evident direction of the housing evolution process in Seoul, then it could be the “selection” in the market that facilitates it.

4.6 Conclusion: genotypical property of space

From the beginning in the 60s, the aim of the new apartment housing development in Seoul was to modernise and enhance the people’s living. For some planners, the old domestic culture was regarded as outmoded and unhealthy thus not suitable for the modern way of living. They thought the apartment house that came from the West should enclose the western style of living. In some of the earlier apartment plans, they raised the floor of the bathroom up to the level of the living room, and provided radiators, instead of the floor heating, in the bedroom. When the residents moved in, however, they resisted the planners’ intention; they had the floor level of the bathroom re-lowered in Hangang apartment housing in 1970 and installed hot pipes under the floor to restore the floor heating in AID apartment housing in 1974 (Zchang, 1994, Kang et al., 1999).

The transformation process of the domestic code described in this chapter is to show that it is not simply the changing arrangement of rooms but the interaction between the space and its activities within the domestic field that can precisely define the new space, and there is an indigenous concept of level-distinction that was actively involved in this process. Guided by these underlying forces, the evolution of the housing in Seoul has followed certain topological paths to adapt the old genotypical properties to the new physical environment, and the user’s reaction described above shows that these values do persist through the formal changes.

Chapter 5

Morphology of Apartment Houses in Seoul: graph-theoretical analysis

5.1 Introduction: form as a mould for space

5.2 Graph theoretic method

5.3 Analysis of the staircase access type plans

5.3.1 Finding shared morphology in the sample

5.3.2 Deterministic characteristics in Morphology

5.3.3 Syntactic pattern in morphology

5.3.4 Syntax and morphology

5.3.5 Design intuition reflected in plan morphology

5.4 Analysis of the balcony access type plans

5.4.1 Finding the shared morphology in the sample

5.4.2 Deterministic characteristics in morphology

5.4.3 Transformation of the kitchen

5.4.4 Design intuition reflected in plan morphology

5.5 Synthesis and conclusion

5.1 Introduction: form as a mould for space

Put simply, ‘space syntax’ was designed to analyse spatial configurations that contain information on how ~~an~~ each unit of space is related to all the others in the system. In the previous chapter, by means of this method, the evolution of the domestic space in Seoul was investigated and the hidden symbolic dimension that was actively involved in the evolution was revealed. It is evident from the analysis that while the formal comparison of the old and new houses only exposes discrepancies, by tackling their topological relations, a continuous changing process could be successfully shown. Accepting this kind of evidence, it is hard to dispute the view of Hillier and Hanson:

“We are convinced that it is unnecessary to specify shape in order to model real-world generative process; indeed, that the concept of shape obscures the fundamental relational notions that underpin human spatial order.” (Hillier and Hanson 1984, xii)

In general, this statement cannot be denied, as a considerable amount of space syntax research has shown that it is genotype rather than phenotype that conveys social information. There could be always some cases, however, where shape, or rather form, should not be relegated to a minor role as elaborated by Brown (1990; see figure 2.17 in chapter 2). Boast also argues that topological and formal measures “cannot be defined without reference to the other and they are, therefore, separable only in analysis and not in practice” (Boast 1987, 451).

Although this kind of view does not undermine the authority and utility of space syntax as discussed in chapter 2, this line of thought should be taken seriously in this chapter. This is because, for the apartment houses in Seoul, form is not the phenotypical manifestation of the genotypical spatial intuition; on the contrary, it strongly imposes an initial condition of housing in which space has to fit in afterwards, sometimes sacrificing desired configurations. In this chapter, therefore, the design logic of modern apartment houses in Seoul is analysed in terms of the interaction between form and space, and this will answer the third sub-question of this thesis, *‘how is the spatial intuition from the past accommodated within the formal constraints of modern housing?’*

5.2 Graph theoretic method

As discussed in chapter 3, one peculiar trait of the Korean apartment housing is that only a few prototypes are repeatedly used. At the early stage of the design, access patterns are selected, in most cases, from the two dominant access types, i.e. the staircase access type and the balcony access type. As can be seen in figure 5.1, the typical building shape for both access types is a thin slab block in which units are linearly arranged in each floor. Units in the balcony access block always have their entrances on the public balcony side, so they are accessed from the open backside that generally faces the north or the west [figure 5.1(a)]. Compared to this, unit entrances of the staircase access type always face the public staircase that is placed between two units on each floor; thus the units are accessed from sidewalls [figure 5.1(b)].

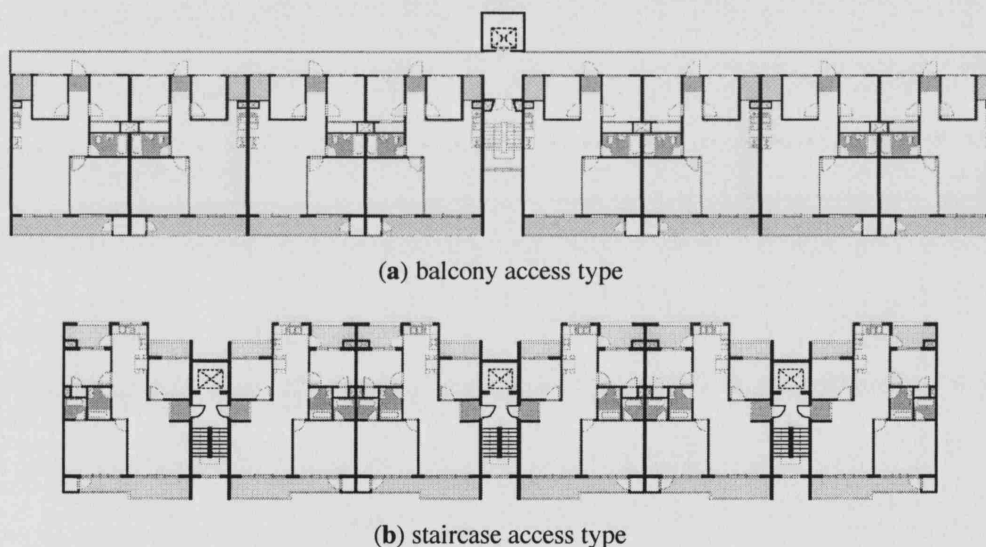


Figure 5.1 Two dominant block plan types

In short, most of the apartment units in Seoul are basically 'open-ended' plans in Sherwood's term (Sherwood 1978, 6-17) that are entered from sidewalls or rear public balconies in relation to their building access patterns. It can be said that the typical building shape, in association with the typical access patterns, already defines the boundary morphology of the unit plans in it.

Concerning this conventional practice, the key issue in this chapter is how far this strongly regulated building shape could affect the way in which the freedom of unit planning within it is expressed. When the outer boundary and access pattern are roughly

pre-determined, designers' options are limited and their creativity lies merely in the re-arranging of the interior rooms. Steadman, drawing on Tabor's definition, described this type of design as a 'permutational approach' as against an 'additive approach', and explored the way in which an empty rectangular house plan is filled in by rooms in accordance with 'adjacency requirements' (Steadman 1970, 4-12). In order to make the dissected rooms correspond to the four compass directions of the surrounding exterior space as well as to one another, he suggested a graph representation as in figure 5.2.

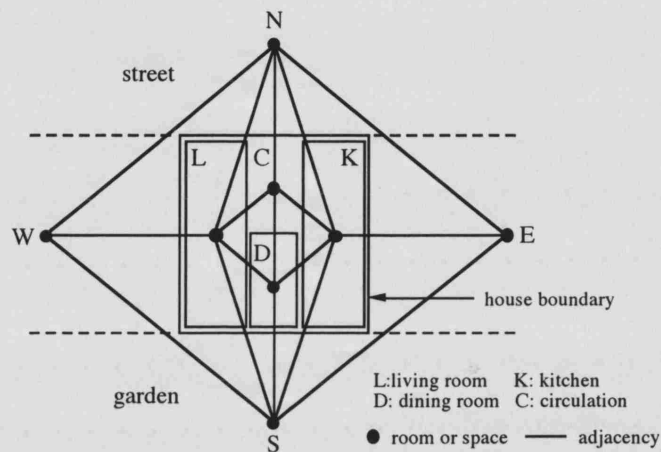
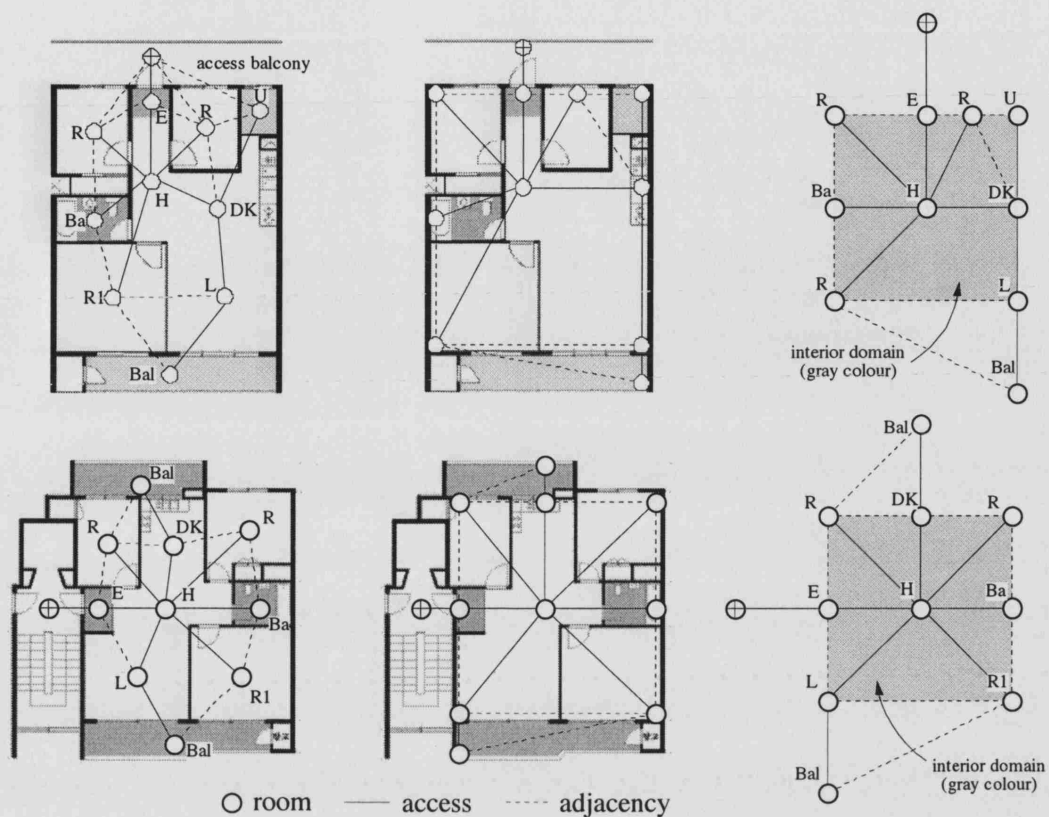


Figure 5.2 Adjacency graph for a hypothetical terrace house (reproduced from Steadman, 1970, p.12)

This kind of graphic representation can be particularly useful for the analysis of this chapter in which the purpose is to find not only the syntactic relations of domestic space but also the overall shaping rules of its frame in relation to the building structure. For the analysis of the sample plans, however, this paper proposes a more 'easy to read' graph representation that could include more information in a less complex format (figure 5.3).



(a) nodes in the centre of each room (b) nodes stretched to the outer edge (c) dimensionless representation

Figure 5.3 Access-adjacency graphs mapped on plans and their transformation to represent the morphology¹ (R:bedroom, R1:main bedroom, L:living room, E:ent hall, H:central hall, DK:dining-kitchen, Bal:balcony)

In figure 5.3(a), nodes are placed in the centre of each space and they are connected by continuous and dotted lines to represent access and adjacency respectively.² Next, the nodes inside the rooms facing the exterior boundary are stretched and aligned to render the form of the graph as a rectangle [figure 5.3(b)]. This is to represent the outside compass directions directly by four sides of a rectangularised graph instead of relying on Steadman's outwardly extended lines as seen in figure 5.2. Finally, in figure 5.3(c), the graph is trimmed and modularised in a square format that loses the dimensions of the original plan. Here, balconies are placed outside the interior domain of the graph which is marked by a gray colour. Containing three types of information, i.e., access, adjacency, and boundary orientation, this graph can facilitate the precise analysis and comparison of the otherwise hard-to-grasp minor variations in the sample plans. More

¹ In this representation, small spaces like wall closets are ignored, and when two rooms in the plan are adjacent by a length of wall shorter than a door opening, they are not regarded as adjacent in the graph.

² The concept that the access and adjacency are considered together and distinguished by continuous and hidden lines has been taken from Brown and Steadman's work, 'The morphology of British housing' (1991b, pp.400-401).

importantly, by storing the information of both syntactic and formal data, this graph can demonstrate how the topology of a unit corresponds to its building morphology. From the testing of all the plans in the sample against this graph representation, it was found that they could easily fit to this graphic representation.³ In the following sections, the sample of 132 modern apartment house plans from the 70s to the 90s in Ghangnam-gu of Seoul, of which 75 are staircase access type and 57 balcony access type, are examined in the light of this method (refer to chapter 3 for the sampling method).

5.3 Analysis of the staircase access type plans

Through the process of transformation, 75 sample plans were represented by 43 graphs. On average, there are 1.74 plans per graph, but it is found that some types of graphs were more heavily used than others, which means that a small number of typical topologies are embedded in many geometrically different plans. Below are the four most frequently used graphs with one of the corresponding plans on the top of each graph (Figure 5.4).

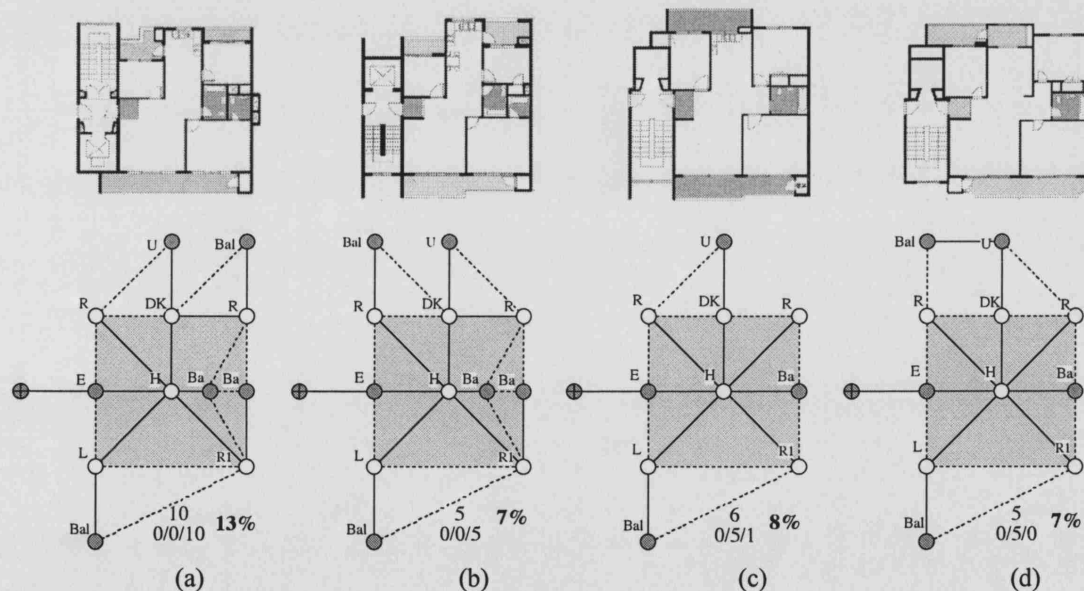


Figure 5.4 The four most frequently used graphs and corresponding plans (for clear distinction between rooms, sunken floored spaces are marked dark)

³ Basically, it is possible to use this graph method to represent other architectural plans. Its methodological benefit can be maximised, however, when it is applied to rectangular shape plans with the sizes of small houses. In the case in which a plan has only one room in any one boundary side, it is necessary to use a dummy cell because any one boundary side needs at least two room cells to represent two end points.

Graph (a) in figure 5.4 is the most repeatedly used topology for the 3 bedroom staircase access apartment houses in Ghangnam-gu area; the numbers on the bottom of the graph mean that this type of plan was used in 10 different apartment complexes and that exclusively in the 90s. In the case of graph (c), 6 plans can be represented by it, with 5 of them from the 80s and 1 from the 90s. Out of 75 sample plans, 21 plans (34.7%) are following these four dominant patterns. Relating these four graphs to one another, one can notice that graph (a) and (b) are exactly the same except they have different arrangement in the north balconies: the balcony on the right is shifted to the left and this caused some changes in adjacency. Similarly, (c) and (d) share the same topology of rooms except for the variation in the north balcony side.

5.3.1 Finding shared morphology in the sample

Now, from the similarities of the graphs, it is expected that if some of those additive features outside the interior domain are omitted, then a more inclusive pattern can emerge. Following this idea, it is possible to generate sub-graphs that are shared by a multiple number of original graphs (figure 5.5).

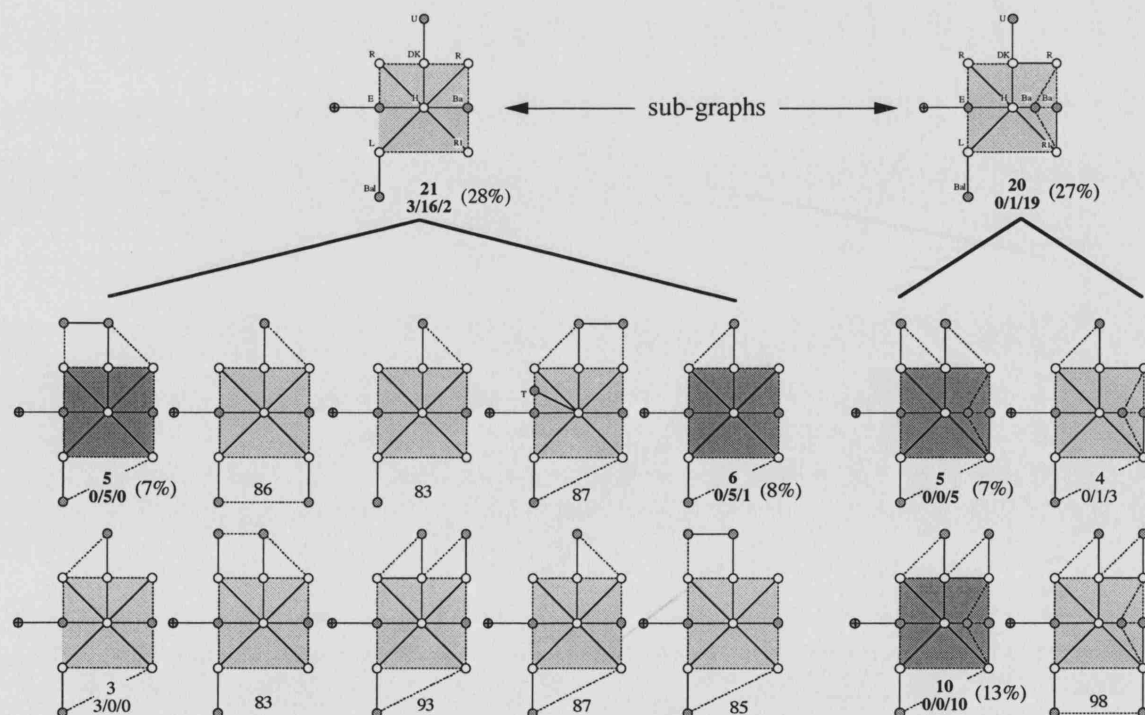


Figure 5.5 Process of making sub-graphs from the original plan graphs
(darker ones are the four most frequently used graphs in figure 5.4; when there is a single number under a graph, e.g. 87, 93, etc., this means the graph appeared only once in the year of that number)

By stripping off some nodes and lines – mainly in the balcony side – those two sub-graphs on the top of figure 5.5 became the common denominators of many original graphs below including the four most frequently used ones which are coloured darker. Masked by the variations in the balcony zone, these original graphs looked very different but it turned out that they have exactly the same arrangement of interior rooms. Out of 75 sample plans, 21 plans share the sub-graph on the top-left as an identical part and 20 the one on the top-right. In other words, more than half (54.7%) the 3 bedroom staircase access plans in Ghangnam-gu area in Seoul are following these two types of interior morphology, and this confirms the existence of few dominant patterns which has been argued by other studies dealing with the Korean apartment housing (figure 5.6).

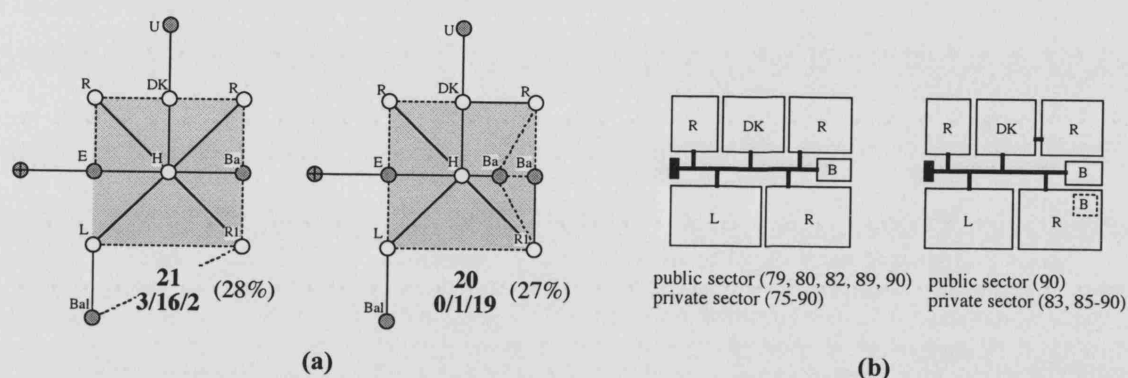


Figure 5.6 Two different types of representation for the most dominant plans [(b) is reproduced from Kim and Park, 1992. Below the plans are the years of appearance between 1962 and 1990]

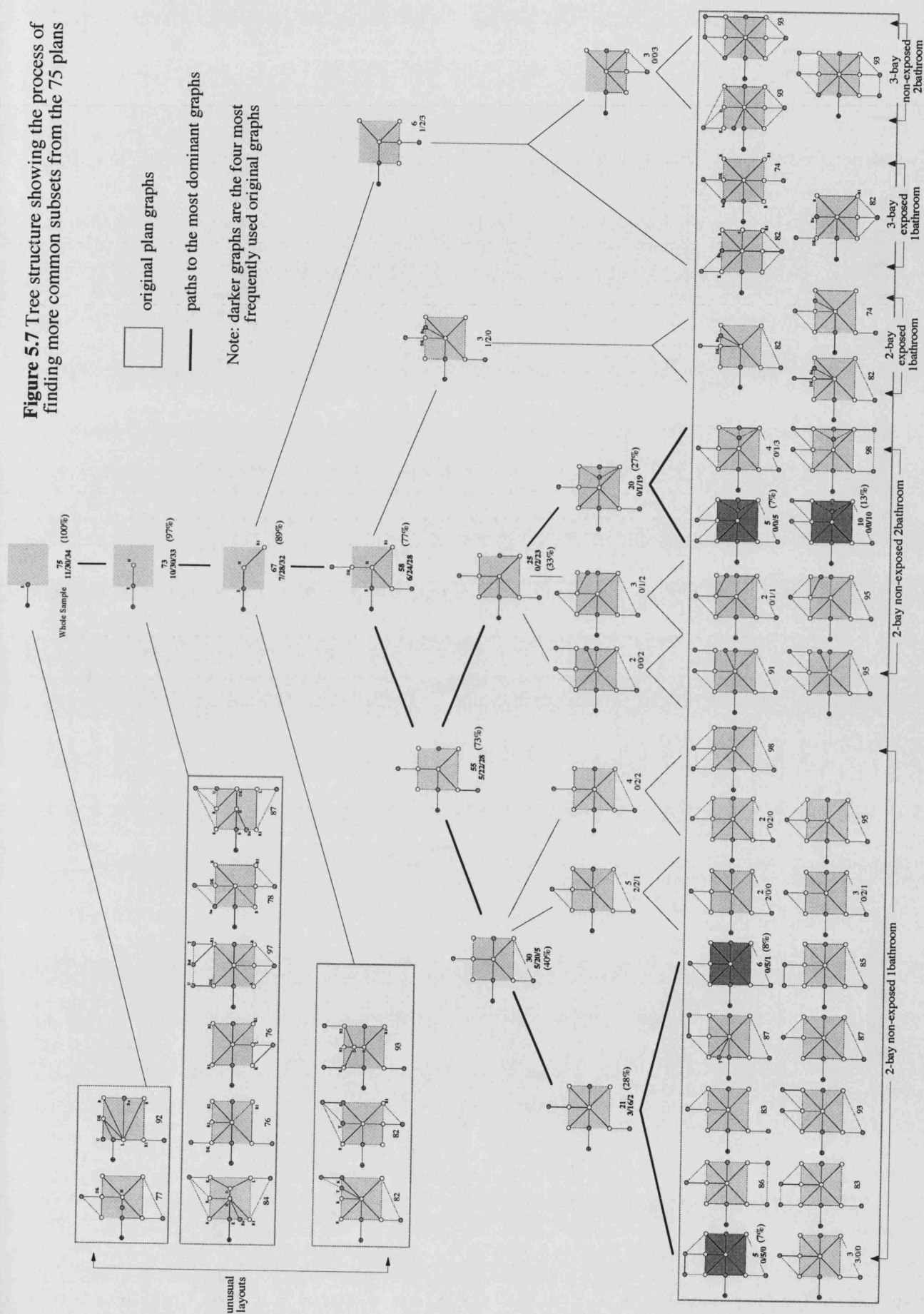
In their study, Kim and Park, from the analysis of almost all apartments built between 1962 and 1990 in metropolitan Seoul, found out that only a small number of plans are adopted 'constantly and ubiquitously' (Kim and Park 1992; see chapter 4 for the full description of their research). From the typical plan types they suggested, it is recognisable, though they did not describe about the proportion of each type in the market, that two plans were most dominantly used by the public and private sector for a relatively long time [figure 5.6(b)]. By comparison, these two plans, which are the simplified representation without the periphery balcony zone, exactly match the interior structure of the graphs in figure 5.6(a), and this fact clearly shows that their metropolitan-scale observation is equally adaptable to the area focused upon in this research.

When those two graphs in figure 5.6(a) are compared, the major difference lies in the extra bathroom added in the graph on the right. Interestingly, it is found that this addition

makes these two types clearly divided by era; the one with a single bathroom was mainly used in the 80s while the other with two bathrooms in the 90s (refer to the numbers on the bottom of each graph). In figure 5.6(b), below the plans are the years they appeared in Metropolitan Seoul between 1962 and 1990. From this information, it can be understood that these two plans were initiated first by the private sector and then their dominance was much more strengthened when the public sector, recognising their popularity, took part in supplying them after several years' delay. This suggests a possible reason why the concentration of each plan, at least in the sample area, happened in the 80s and 90s.

As examined from above, by means of extracting the same elements from a plural number of graphs, a new sub-graph as a common denominator can be generated. Through the successive application of this process, graphs are converted from the direct translation of real plans to more inclusive sub-graphs, and finally arrive at a single sub-graph that is the universal part of the whole sample (figure 5.7). This is a pyramid-shape bottom-up process where the wide-ranging types of graphs below are recursively converged to a smaller number of sub-sets above. It can be found that the first stage of generating sub-graphs shown in figure 5.5 now becomes a part of the whole tree structure; those four most dominant original graphs are still coloured darker.

Figure 5.7 Tree structure showing the process of finding more common subsets from the 75 plans



In the tree structure, the graphs connected by thicker lines are the most dominant patterns in each phase of the sub-graph generation. In figure 5.8 are some of these dominant patterns taken from the final five phases.

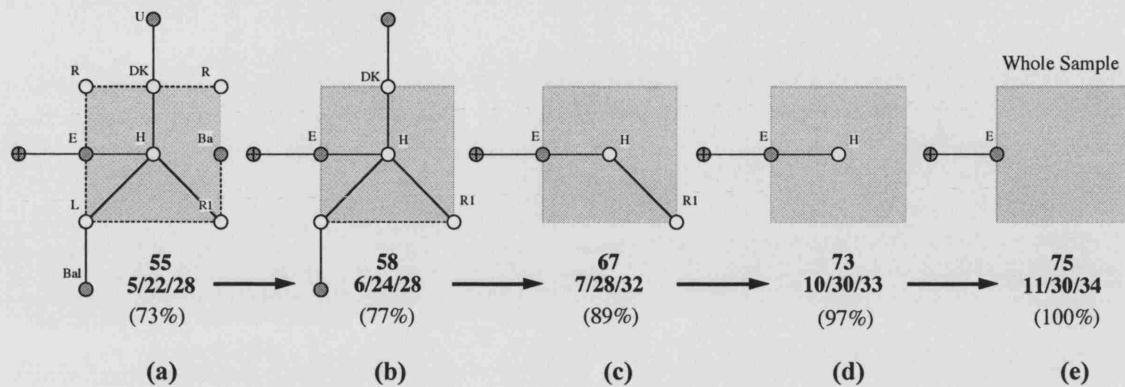


Figure 5.8 five dominant sub-graphs taken from the final five phases

The graph on the left side is gradually transformed to the simplified sub-graphs on the right side to produce more inclusive common denominators within the morphology of the 75 plans. The first graph (a) is the intersection of 55 plans; this includes the 41 plans that belonged to the two graphs in figure 5.6 plus 14 others, thus amounting to 73% of the sample. Unlike the graphs in figure 5.6, it now turns to an unrealistic format where some rooms have no access line at all. It is, however, the last sub-graph with all the primary rooms preserved. Since the following ones, (b), (c), (d), and (e) have only the partial structure of the domestic room layout, it could be regarded as the most informative sub-graph that suggests the 'most widely accepted' layout pattern. Given the sample area could adequately represent the whole city, a generalisation can be made that 73% of the 3 bedroom plans built in Seoul could be generated based on this pattern. The graph (a) also strongly suggests a possibility that the design of apartment units in Seoul may be following design logic that the positions of interior rooms are placed first and, then, the syntactic connection of these are added later. This can be deduced because of the fact that many plans with different access links share this layout of room positions. This issue will be discussed in detail in the next sections.

In graph (c) much of the internal layout information is lost but in return it expands its coverage up to 89% of the sample. What looks unusual here is that it has gained only 12 more plans even though it has deleted a significant portion of graph (a). This happens because those plans that do not conform to the typical layout of graph (a) tend to have such a wide-ranging variety of layout that they do not share much of the morphology

with graph (a) or with one another. It is noteworthy, however, that even these abnormal plans still keep the main bedroom R1 always at the farthest south corner from the entrance and accessed directly from the central hall.

Syntactically, this main bedroom is equally deep from the exterior as the other bedrooms and living spaces, but morphologically it is located in the “best” south spot on the deepest side. This gives a suggestive idea that ‘the perception of distance’ may be another aspect that affects the spatial arrangement. It could be a minor consideration in the planning of domestic space but as Blanton (1994, 30-31) points out it is sometimes meaningful to rank “the relative access of rooms by reference to the “distance” from the entrance expressed in terms of numbers of crossovers.”⁴ In the apartment plans of Seoul, though the structure is rather compact and small, it is possible that this line of thinking may have been applied to the positioning of the main bedroom.

This remaining habitable room, the main bedroom, disappears in graph (d) and only the entrance and the central hall remain. Now, a majority of 73 plans (97% of the sample), excluding only 2 plans, conform to this pattern. The central hall therefore can be regarded as one of the most unique and fundamental aspects which characterises the morphology of the staircase type apartments in Seoul. Finally in (d), only the entrance hall is placed on the entire domestic area. This final graph is a universal element of the whole sample of plans, thus placed on the very top of the graph tree, and this means that the staircase type 3 bedroom plans in Ghangnam-gu are all accessed from the side without exception.

5.3.2 Deterministic characteristics in Morphology

Graph theoretic representation of the 75 sample plans was conducted in the previous section and the dominant patterns were found by generating the sub-graphs which are the combination of nodes and access and adjacency lines. As mentioned in the last section, through the process of sub-graph generation, an interesting question arises: why do some

⁴ Drawing on Friedman (1975, 62-63), Blanton further notes that “crossovers (“pseudonodes”) are points of possible conflict in movement and are points of decision to the person passing through the structure and thus could be important additions to certain architectural analysis, particularly in the case of very complex structures.”

rooms appear repeatedly in the same position regardless of their internal configuration? This is a meaningful question to understand the design logic, or rather intuition, of the apartment houses in Seoul. If the assumption that some rooms are pre-fixed in specific locations before syntactic links are considered is right, it means that in Seoul form imposes itself on space not as a modifying factor but as a determinant factor from the initial stage of the design. To test this assumption, a different approach is made; only the position of each room, without considering its adjacency and access links to other rooms, is investigated in this section.

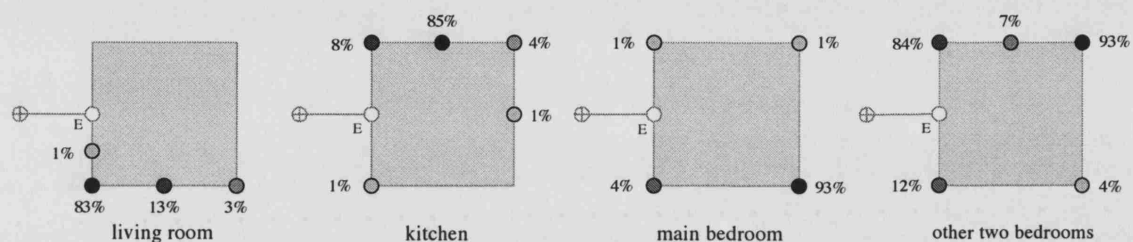


Figure 5.9 Statistical position of each functional room
(the darker the dot, the higher its percentage)

Overlapping the position of each room from the 75 sample plans, the statistical distribution of the rooms appears (figure 5.9). The result strongly confirms the assumption that the design is guided by a certain grammar which prescribes the position of rooms. For the location of the living room, the lower left corner is unrivalled and the lower middle comes next. Ignoring the 1% exception, which is only one instance in the sample, this room has never left the south edge. The kitchen's case is quite the opposite; while the most dominant position lies in the middle of the north, its position comes mostly along the north boundary line. Next, the main bedroom's preferred location is the southeast corner and, interestingly, all cases happen only in the corners of the interior rectangle. The location of the two extra bedrooms is mainly in either corner of the north side, but at the same time the middle of the north and the southwest corner seem to have been the secondary choices. These four spaces in figure 5.9 could be termed 'habitable rooms' as opposed to other non-habitable rooms, i.e., bathrooms, halls, balconies, and entrance halls (Steadman, 1991a). It is a natural tendency in any type of dwelling that these spaces are so positioned as to face the exterior for the light and fresh air. For the apartment houses in Seoul, since those four habitable rooms above are all located, with few exceptions, along the open edges in the north and south, it can be arguable that this tendency is actively operating.

Concerning the degree of distribution, no other rooms can parallel with the bathroom. In figure 5.10, the diagram on the left shows that its possible positions are widespread across the domestic field. Considering the fact that the size of it is much smaller than the others and, secondly, it does not have to face the exterior when artificial ventilation is provided, this diverse positional choice of the bathroom seems natural. While the most dominant position is the middle of the farther side from the entrance, the separation of the graph into two different versions can reveal more information. The two graphs on the right side were created by separating the sample plans with respect to the numbers of bathrooms per unit. It can be found from the numbers under each graph that the two bathroom plans dominated the 90s and the one bathroom plans the 70s and 80s.

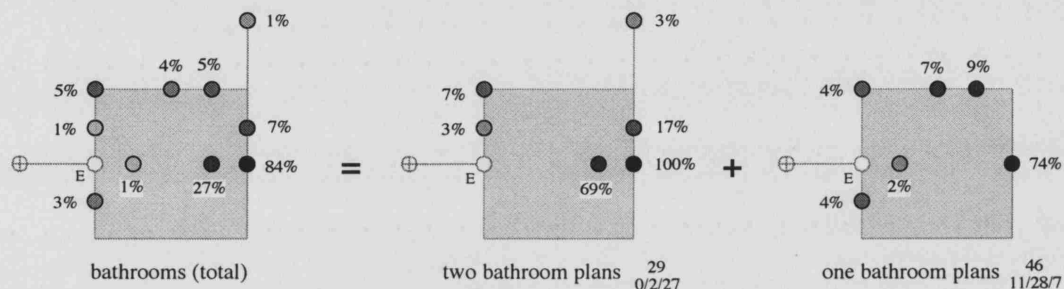


Figure 5.10 Statistical position of the bathroom

A major finding from this separation is that the middle-right position, the most dominant spot, is occupied in 74% of the one-bathroom plans but, in the two-bathroom plans, this position is 100% reserved for one of the bathrooms. In the mean time, it is also found that the second and third most frequent spots in the sample – the nodes marked 27% and 7% – only appear in the two bathroom plans. This means those two are the subordinate attributes which can be only considered when there is a need for extra space for the second bathroom; if there is no need for it, they never occur.

Now, from the statistical positions of each room, only the highest-rated locations are picked and they are arranged on a single rectangle (figure 5.11). The first graph on top represents the whole sample and its percentages are directly taken from figures 5.9 and 5.10. All the nodes in the graph have more than 80% of dominance and this shows how typically each room's position is decided. In the sample, the instance in which all the six nodes appear simultaneously in a single plan exactly on these spots amounts to 73% – 55 out of 75 plans – as already seen in figure 5.8 (a). If the access and adjacency lines are

added and make combinations with the nodes, the number of theoretically possible graphs can be greatly increased, but, in real plans, those two types of arrangement in figure 5.6 (a) are more frequently used than the others to occupy more than 50% of the sample.

More revealing sub-graphs can be made by splitting the sample into three different periods. The three graphs at the bottom of figure 5.11 deal with the plans from the 70s, 80s, and 90s separately. While the location of the six key rooms is unchanging, their percentages vary according to the three phases. The percentages of the bathroom, the living room, and the main bedroom are all rising up as time passes, and this means that their positions are getting more and more fixed in the later periods. On the other hand, the percentages of the two bedrooms and the dining-kitchen in the north do not have clear tendencies; each of the three graphs contains one highest peak.

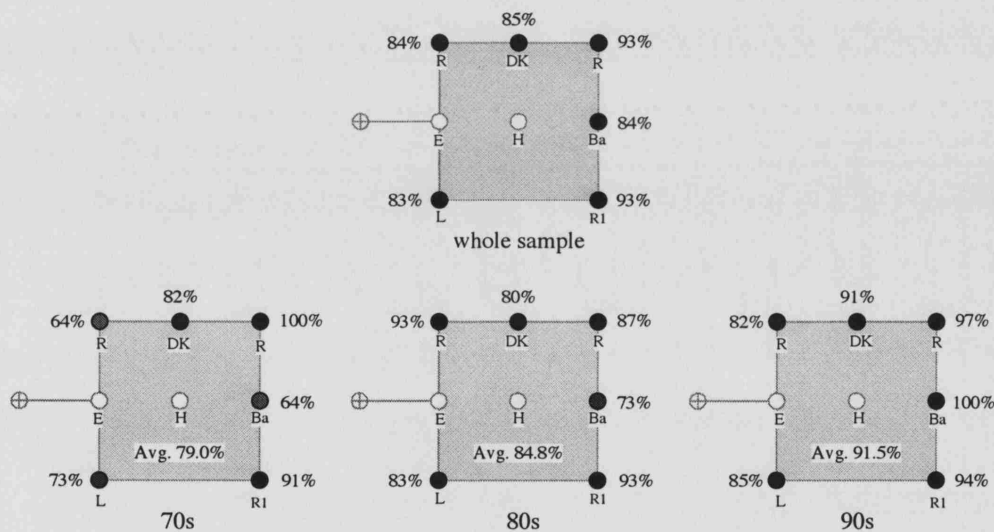


Figure 5.11 The most dominant positions of the six key rooms combined in a single graph

On a closer look, however, it can be realised that when these positions that do not conform to the trend are considered together, their average percentage is also increasing from the 70s to the 90s. Consequently, from the whole graph's viewpoint, it is safe to say that this format of room arrangement is becoming more concretised through time, and this can be verified again from the fact that the average percentage of all the six dominant positions is gradually rising from 79.0% in the 70s to 84.8% in the 80s and 91.5% in the 90s (see the average inside each graph). It is evident from this fact that the staircase type units in Seoul tend to follow a few successful precedents in the market,

and consequently, this entails their morphological diversity – which already has given limits by the stereotyped building envelope – becoming more restricted as time passes rather than expanded.

5.3.3 Syntactic pattern in morphology

What has been brought to light from the analysis in the previous sections is that there exist strong patterns in arranging the rooms in the apartment units in Seoul. When the rooms are categorised into the habitable rooms and non-habitable rooms, as discussed before, a broader zoning concept can be obtained. In figure 5.12 (a), these two zones are reiterated longitudinally from the south balcony to the north balcony.

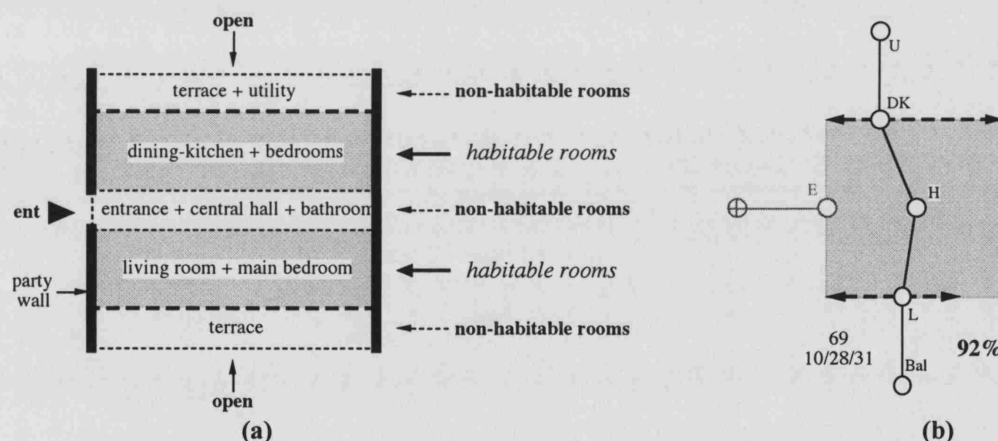


Figure 5.12 (a) vertical layout zoning of the 3 bed staircase-access units (b) vertical sequence of rooms (the arrows in figure(b) indicate possible ranges the living room and the dining-kitchen can appear)

In this longitudinal zoning, every habitable room is placed so as to face the semi-exterior non-habitable zone, and this happens symmetrically at both ends. This type of zoning, however, is not culturally specific; within this type of linear unit which is open to the exterior at two opposite sides, this zoning solution seems ideal as advocated in the SAR method in the early 60s (Habracken et al 1976).⁵

⁵ In the SAR method, the longitudinal zoning concept is basically the same as figure 5.12(a) but the detailed zoning is more sub-divided. For example, there are marginal zones between the zones and the habitable spaces can be extended to the non-habitable zone. Consequently, the example unit plans in the SAR method look much bigger than the sample plans in this thesis. Within the same zoning concept, the apartment plans in Seoul are more affected by the close-packing effect.

Interestingly, amongst many possible access links to connect the 5 zones, one link is strongly embedded in most of the plans, though its manifestations in plans do not all follow the same morphological pattern [figure 5.12 (b)]. If only the syntactic relation, not the morphological position, is considered, this connection of 5 rooms – the balcony, the living room, the central hall, the dining-kitchen (or kitchen), and the utility; one from each zone – is found to exist in 92% of the sample plans. While the position of the central hall is almost always fixed in the middle, the positions of the dining-kitchen and the living room can be rather flexible running along the north and south habitable zones respectively – this can be verified by looking at the distribution of the statistical position of these two rooms in figure 5.9.

If this permeable sequence is something essential in the apartments in Seoul and, as a result, all the 5 spaces in it should be treated as a single syntactic entity, the unit planning cannot be done by a ‘permutational approach’ or by ‘filling in the empty box’ with separate pieces of rooms as mentioned earlier. Rather, the design is more like squeezing the long fluid line of syntactic structure into a rigid form of boundary while still satisfying the other connections. In a sense, it is the interaction between this longitudinal syntactic link and the rest of the required spaces to find optimum solutions, through which the morphology of the apartments in Seoul is determined. In what follows, this relationship between syntax and morphology is further investigated.

5.3.4 Syntax and morphology

In section 5.3.1, the tree structure was constructed by recursively generating common sub-sets from the original plan graphs and through this process, the morphological characteristics of the apartment houses in Seoul were identified. In this section, a more theoretical question is raised: amongst many combinatorial possibilities of interior layouts, what forced the designers in Seoul to choose those particular solutions?

One idea to look into this question is to test their primary choices against the other minor choices. In other words, the dominant patterns in morphology can be better understood in the light of the non-dominant patterns in each phase of design. Through the examination

of the morphology of the atypical patterns, it is hoped that the reason for the designers' strong preference for the typical patterns can be more logically explained.

In figure 5.13, the graphs coloured darker on the left are the four dominant sub-graphs taken from the final four phases of the tree structure and on the right are all the other minor types of graphs. The universal graph on the top-left has no alternative choice on the same level; every plan follows this single most dominant pattern. In the second row, the sub-graph with the central hall in the middle includes 73 plans as the number below indicates and the other 2 minor competitors are shown on the right (the total instances in each phase should be always 75, so as to be equal to the total number of the sample).

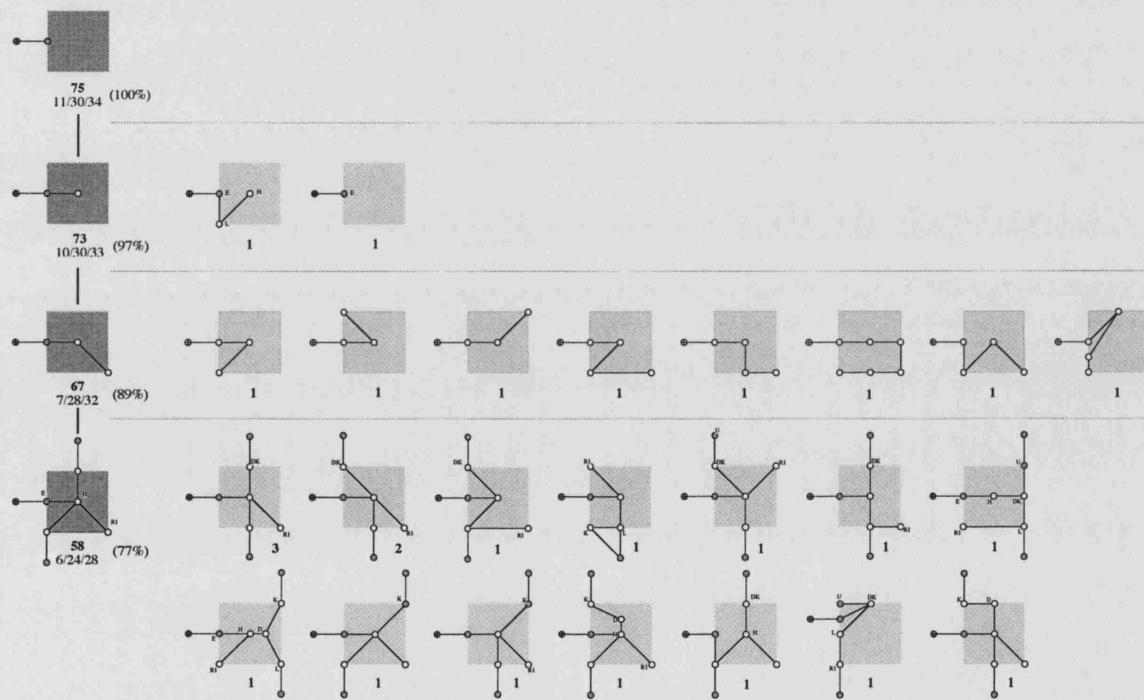


Figure 5.13 Four dominant sub-graphs (coloured darker) taken from the final four phases of the tree structure in figure 5.7 and all the other minor types in each phase

In the third row, 67 plans conform to the typical pattern on the left and the other 8 plans take the minor patterns on the right. Lastly, in the fourth row, the dominant graph on the left gets more morphological information but in return the number of the plans that converge to this pattern decreases to 58 and there appear 14 other minor patterns to which the other 17 plans belong. In general, as one goes down from the top of the tree structure, the dominance of the major sub-graph pattern is weakened and at the same time there appears a growing number of other minor choices. In figure 5.13, what should

be pointed out is that except for a few cases, most of the minor graph patterns occur just once. It can be said that it is because they are the result of experimental trials only to be found as not so successful – therefore not replicated afterwards. Does this mean, then, that they would not reveal anything to understand the design logic in Seoul? Ironically, within the compositional tendency of these graphs lies the clue that can help explain why certain morphological solutions are more popular in Seoul.

By visual inspection, it is found that all the graph patterns in figure 5.13, ^{they} be it simple or complex, are produced by combining the access patterns to the three major living spaces, i.e., the main bedroom, the living room, and the dining-kitchen. In this respect, now the access link from the exterior to each of these major living spaces is examined separately.

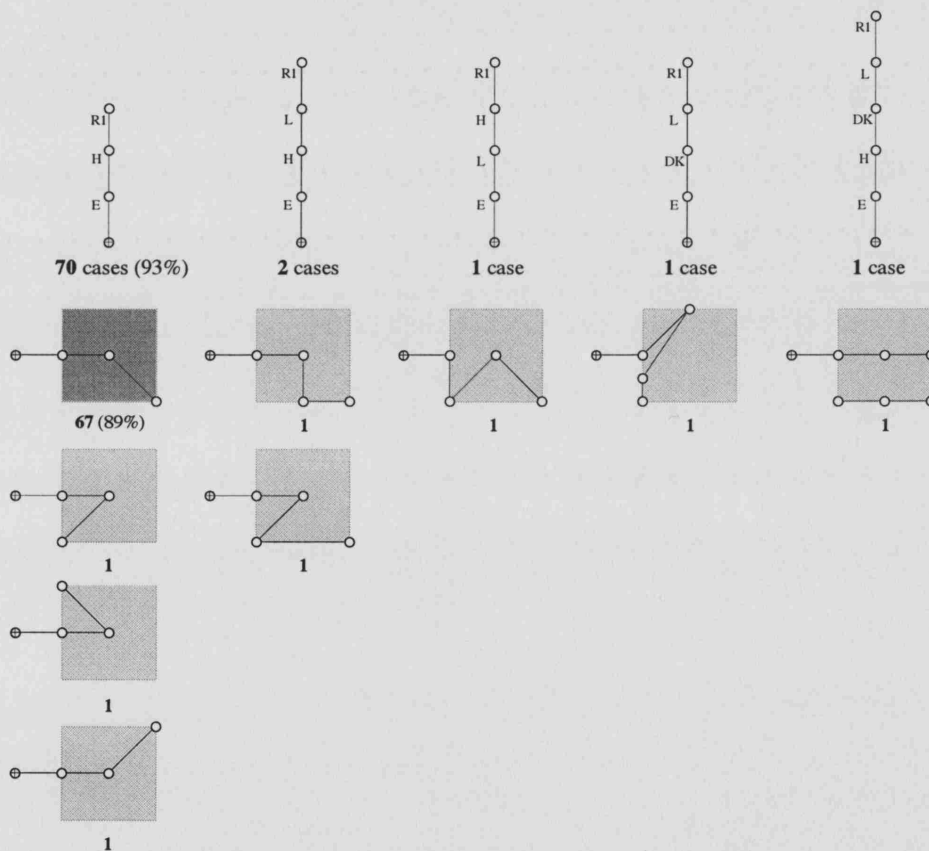


Figure 5.14 All routes to the main bedroom sorted by their syntax

Figure 5.14 shows all the access routes existing in the sample plans that lead to the main bedroom (R1) from the exterior; these patterns are, then, sorted by the types of the justified graph. The justified graph on the far left is the shortest and the longest one goes to the far right. In all cases, the final destination of these access patterns is the main

bedroom. Every graph but one has the central hall in the middle of the plan as a circulation core but not all of them access the main bedroom directly from it. Although their morphological patterns in the plan are all different, the four graphs in the left column access the main bedroom directly from the hall following the shortest syntax; topologically, the main bedroom is 3 steps away from the exterior. In contrast, in the case of the graph on the far right, one needs to go through 5 other spaces before arriving at the main bedroom; so it is 6 steps away from the exterior. In sum, it is found out that more plans are designed in such a way as to have a shallow syntactic pattern for the main bedroom. More importantly, it is not just the number of plans (70 plans) but the number of pattern types (4 types) that verifies the designers' preference for the shallow system linked by the central hall.

The same analysis has been done for the dining room and the kitchen; all the morphological routes to these rooms from the exterior are categorised by the justified graph (figure 5.15).

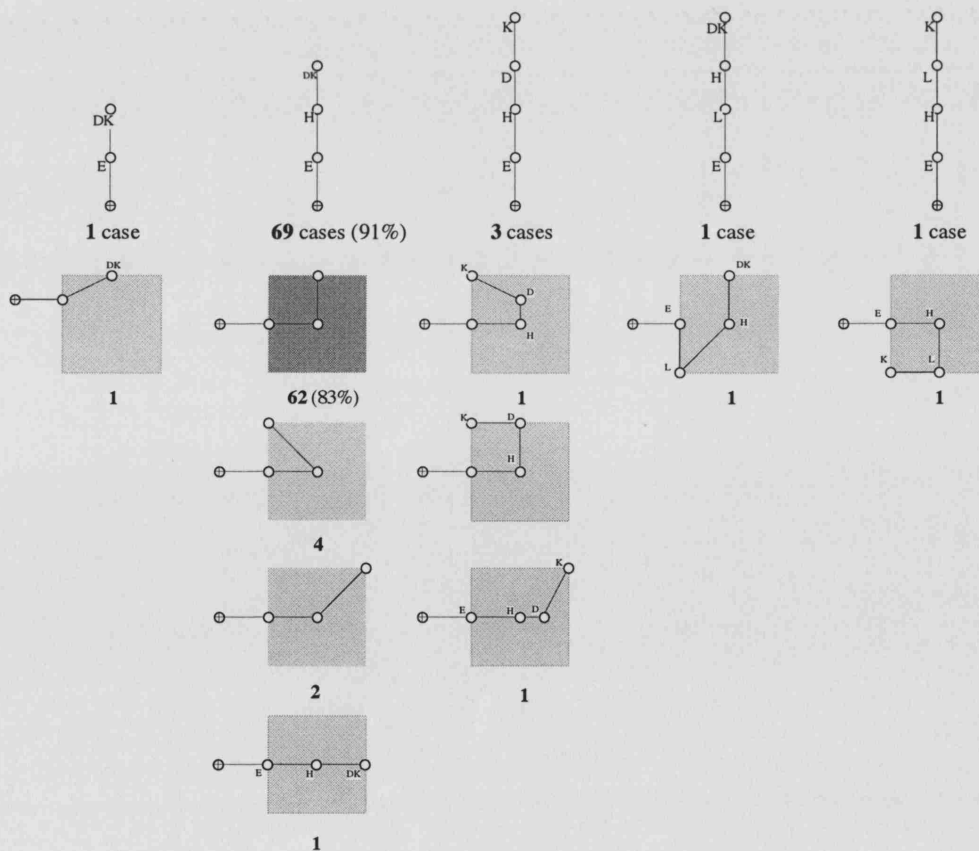


Figure 5.15 All routes to the dining room and kitchen sorted by their syntax

The first syntax on the far left has only three nodes without the central hall and it is embedded in only one plan of the sample. The three syntax from the right have equally four steps of depth from the exterior, though the order of their spatial sequence is different in each case. To be more precise: the plan on the far right has no dining room but the kitchen; the second one from the right has the dining-kitchen in a single space; and all three plans under the third justified graph have the kitchen and the dining room separated in two nodes. The second syntax from the left looks dominant in the sample; it is embedded in a total of 69 plans (92% of the sample) and, more importantly, it has been represented in four different types of morphological formats. Ignoring the exceptional case of the first graph on the left which has no central hall, it can be said that here again designers tended to use the shortest possible syntax, using the central hall to link the dining room and the kitchen, and they preferred to combine the kitchen and the dining room as a single space.

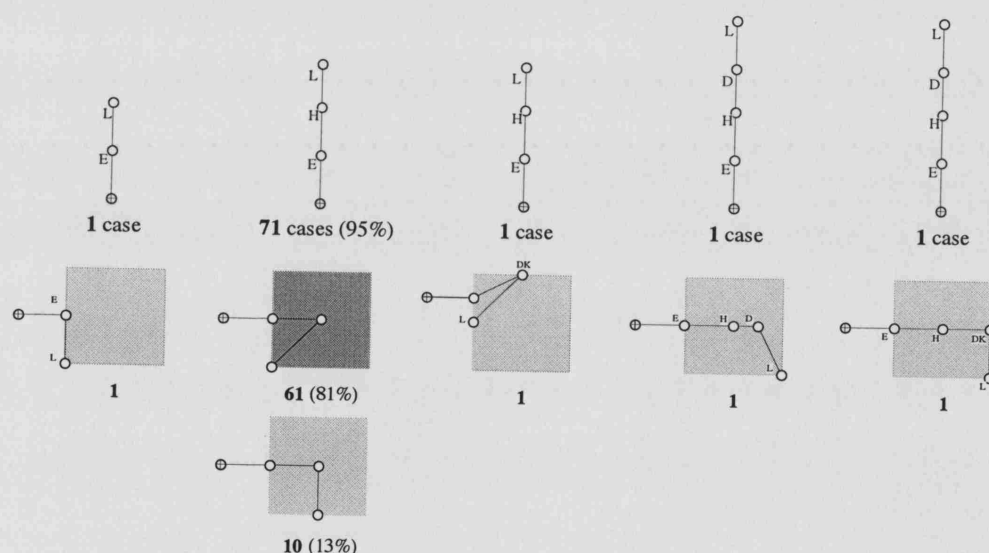


Figure 5.16 All routes to the living room sorted by their syntax

Lastly, figure 5.16 shows all the syntactic links to the living room. The first justified graph on the left has the shortest route where the living room is directly accessed from the entrance hall without going through the central hall. In contrast, the graph on the far right has the room accessed by passing through 3 other spaces, which results in the longest syntax of depth four. Ignoring the ones without the central hall, the shortest route is the second justified graph from the left and it is embedded in 71 plans (95%) using two different types of patterns – the one with the living room in the bottom-left corner and the other in the bottom-middle. Comparing to the previous analyses dealing with the

main bedroom and the dining-kitchen (see figure 5.14 and 5.15), it can be realised that the routes to the living room have a small number of variations – 6 patterns in all. Nevertheless, here again, it is the shortest syntax which is not only selected dominantly but also represented in more morphologies.

In sum, all the three 'route analyses' above suggest that one of the essential characteristics of the apartment houses in Seoul is the shallow syntactic system linked by the central hall. It was found in section 5.3.1 that the central hall was used in 97% of the staircase access plans and 96% of the balcony access plans as a powerful circulation core directly extended from the entrance hall. Since most of the major living spaces are also directly accessed from the central hall, the overall syntax of the apartment in Seoul inevitably takes a star pattern (or shallow bush pattern) where rooms are directly linked around the central space. When the interior domains of the 75 sample plans in Seoul are converted to the justified format (ignoring the link to the balcony zone), it is found that there exist 16 different graph types in all, and most of them are shallow. Amongst them, 7 justified graphs that were used in more than two plans are shown in figure 5.17.

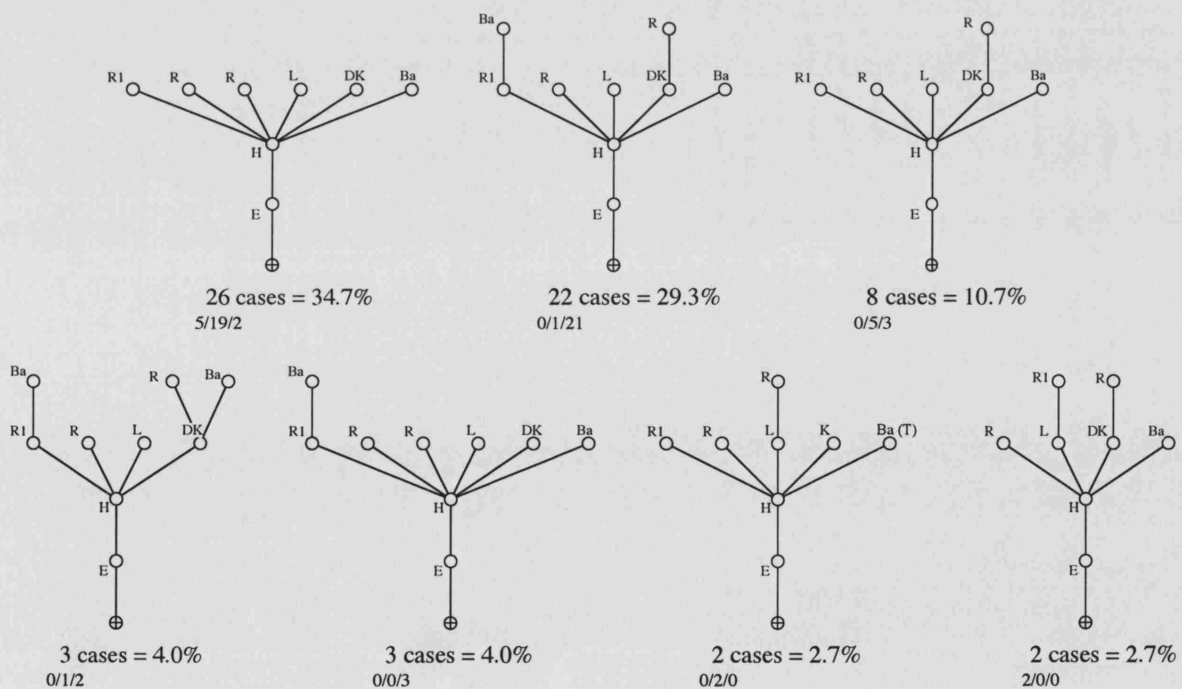


Figure 5.17 justified graphs which are used in more than two 3 bed staircase access plans

In these graphs, balconies and utility rooms are removed; this is because there are many cases where plans have exactly the same topology except for minor variations in the balcony zone as described in the last chapter. By doing this, the total number of justified

graphs can be reduced and the essential relations of permeability for the major living spaces can be more clearly focused. The general form of these graphs verifies the argument that the central hall in the middle binds most of the living spaces, making the overall system shallow. Significantly, the graph on the top-left, which is the most dominant format (34.7%), shows a perfect star pattern. In conclusion, the plan design of the staircase access type apartment houses in Seoul is aiming at a shallow configuration by means of the concentrated circulation on the central hall.

5.3.5 Design intuition reflected in plan morphology

In section 5.3.1, the tree structure was constructed by the recursive generation of the common sub-sets from the original graphs (see figure 5.7). It is a bottom-up process where the graphs above are generated from the ones below, not by arbitrary judgements but by purely mathematical operations. The only chance of arbitrariness in the process can arise in arranging the initial grouping of the original plans at the bottom. Since any initial grouping of the original graphs would necessarily yield a certain amount of commonality in their morphological patterns, there could be many different versions of the tree even though all of them would reach at the same universal pattern at the top.

In fact, this problem is typical in formulating any type of architectural grammar, as described in association with Stiny's shape grammar and Glassie's generative grammar in chapter 2. In order to deal with this arbitrariness, this research takes the principle of 'simplicity' as Glassie did for his grammar construction (Glassie 1975, 21). Based on this principle, efforts have been made to make the tree structure as simple as possible until the final form of the tree shown in figure 5.7 could be constructed. Surprisingly, on examination of this final version of the tree, it is found that it embeds within its structure a hierarchical classification of the plans (figure 5.18).

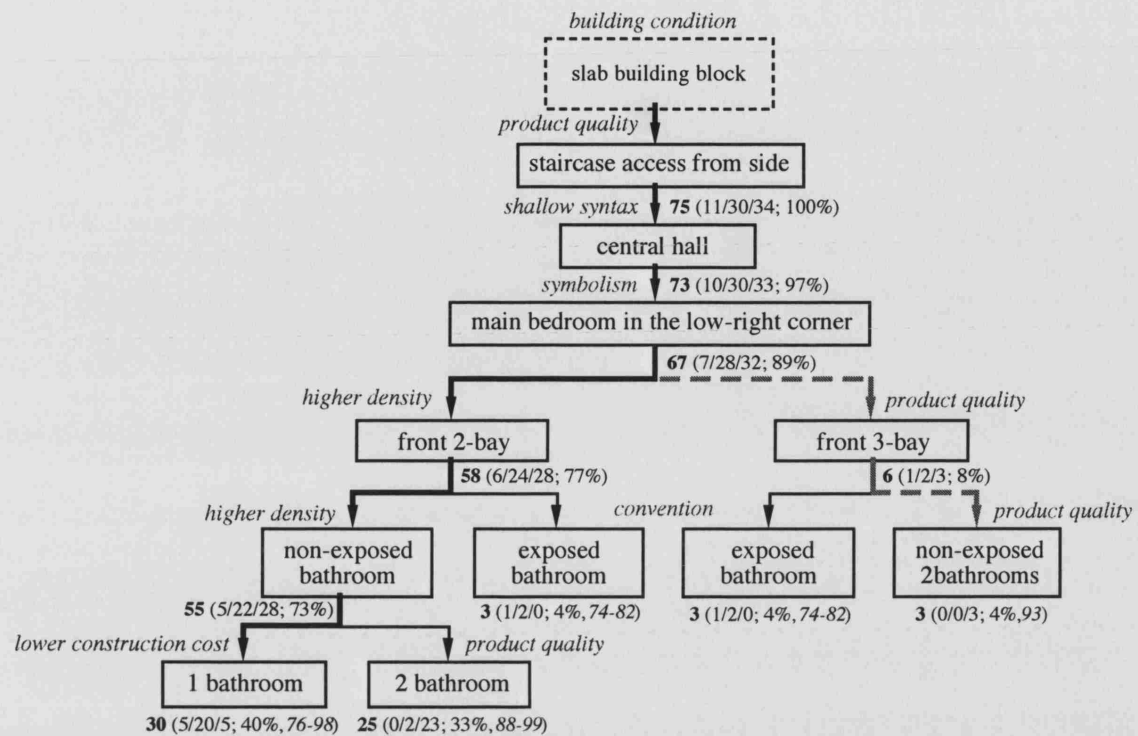


Figure 5.18 A hierarchical classification of the staircase type plans derived from the tree in figure 5.7

[Note: **25**(0/2/23; 33%, 88-99) means 25 plans, consisting 33% of the sample, appeared 0, 2, 23 times in the 70s, 80s, and 90s respectively and the first case appeared in 1988 and the last in 1999; the italic letters above each box indicates the promotive force that attracts the design decision flow; thick black arrows follow the most dominant types and dotted arrows the ideal types for product quality]

Figure 5.18 is derived from the tree structure in figure 5.7 by translating the morphological information of the graphs into classifying types. From each sub-graph, the principal morphological information that can represent all the members it includes is picked up and labelled in the box. With no conflict, the whole tree structure can be neatly converted to this classification format. Unexpectedly, after the process of simplification, it is found that each sub-graph can be defined as a distinct type by one unique feature that no other graph at the same level has.

More interestingly, this classification tree resembles the design decision flow that the designers in Seoul might have followed whether consciously or unconsciously. If the design follows this branching-out pattern of flow, it can be assumed that the final product of the unit planning is reached through the successive choice between two contrasted morphologies – thus by a binary thinking. In this respect, the hierarchical classification diagram can be best explained by regarding the total number of the sample plans as the total number of designers participating in design. This translation is based on the

assumption that a higher percentage of a particular morphology in the sample can be a reliable index that indicates the designers' strong preference for it.

Now, at the top of the tree, let us assume that 75 designers are given a slab-block building shape which has been accepted as most effective for decades. Facing this task, their role is diminished to arranging the interior layout. First, all the designers choose, for building circulation, the staircase access pattern which is more popular than the balcony access pattern from the 80s on. Compared to the other pattern where the rooms adjacent to the north side are facing a public access balcony, this pattern can enhance the privacy of the rooms. In this respect, their motivation for this choice is to enhance the privacy of each unit and, to be more general, the driving force for this choice is the 'product quality' of the plan.

In the next phase, 73 designers (97%) make a decision that the central hall placed in the middle for internal circulation and connected directly from the entrance hall. The driving force for this choice is 'shallow syntax'; as fully discussed in the previous sections, it is the most distinguishable characteristic of the apartment houses in Seoul.

A majority of them (67 designers, 89%) now begin to consider, above all, the position of the main bedroom. They place this most important private space in the farthest south corner from the entrance and connect it directly from the central hall. Although this spot is not deeper than the other living spaces in terms of topology, it is certain that the designers' intention is to give inhabitants and visitors a feeling that the room is in the deepest position and to ensure that the room receives a good amount of sunlight. The driving force for this choice can be defined as 'symbolism' in which the traditional image of 'anbang' persists; even after it ceases to be the best living space for the whole family, the main bedroom is still regarded as the most prestigious space. Amongst the other 8 designers who do not follow this design pattern, a half of them also place the main bedroom in this farthest south spot, but they do not connect the room directly from the central hall – this can be verified by inspecting the non-standard types in the upper-left corner of the tree structure in figure 5.7.

In the next phase, these 67 designers have to choose between the two types: front 2 bay and front 3 bay. In the open front side, front 2 bay has a main bedroom and a living

room, and front 3 bay has a main bedroom, a living room and another bedroom [see figure 5.19 (c), (d), and (e)]. 58 designers (77%) choose the front 2 bay pattern and only 6 (8%) choose the front 3 bay pattern. When the front side has three bays, the front width of the unit gets longer and thus the whole building length becomes longer proportionally. As the site planning strategy in Seoul is, in a normal situation, aiming at higher density for profit, the front 3 bay type can hardly be regarded as an ideal choice for the developers.

In spite of the front 3 bay's disadvantage for the developers as described above, it appears 6 times. Strangely, however, their appearance is concentrated in two periods – 3 of them appear between 1974 and 1982, and the other 3 in 1993 – and there is no appearance between these two periods. Since density was not the most crucial issue at least until the early 80s, this wide fronted type was adopted quite often. During the 80s, however, as the land value represents a greater proportion of the housing construction cost, the front 3 bay type was actively avoided. In the 90s, however, another turn was made; after a steady growth in the housing stock, stronger competition arose between the providers in the housing market. Consequently, they began to try to attract consumers by enhancing the quality of their products, thus accounting for the re-introduction of the front 3 bay type which is preferred by consumers.

As for the consumers' preference for the front 3 bay type, Kang et al. pointed out, though they did not provide analytical data, that people prefer a large open interior space in the apartment house as a replacement of the central courtyard in the traditional house [Kang et al., 1999. pp. 342-346; see figure 5.19(a)]. One of the proofs they suggested was that there is, amongst the staircase access type three-bed plans, a strong preference for the front-3-bay plan developed in the 90s over the front-2-bay type which previously prevailed in the market [see figure 5.19 (d) and (e)].

Meanwhile, it is also highly probable that the preference for the front 3 bays type in plan design has been influenced by the traditional spatial image of housing. In the traditional courtyard house, three living spaces, i.e., the anbang, the maru, and another bedroom called 'geonneonbang,' were always put together [figure 5.19 (a)]. The convention of the traditional plan design where the maru, a divine space where the God governing the whole house is believed to inhibit, becomes the centre of the raised spaces in the 'L'

shape block has been practiced for hundreds of years, and therefore it has been firmly instilled in people's mind as an ideal arrangement for these major living spaces.

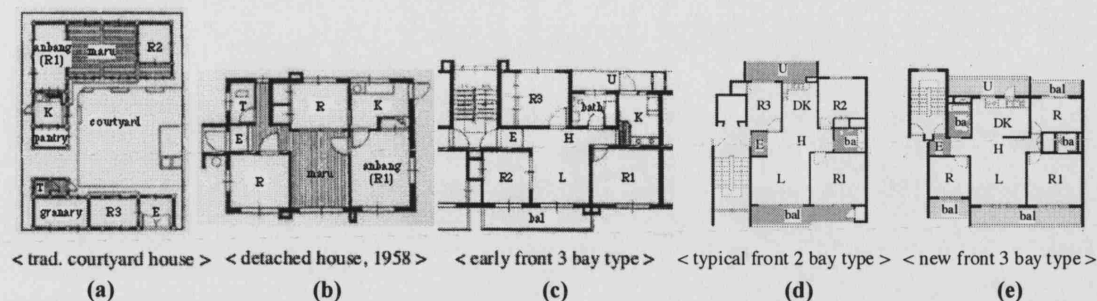


Figure 5.19 Various types of house plans in the 20th century Seoul

The strength of this conventional norm can be examined by looking at the modern houses that emerged in the middle of the twentieth century [figure 5.19 (b)]. These houses took various types of housing form and configuration that are different from those of the traditional house, but the linear arrangement of these three rooms is conspicuous in most of the cases. In the planning of the apartment houses, this spatial image must have been in operation as well, and thus in the case of front 3 bay type, the living room almost always comes in the middle apart from a few unsuccessful exceptions [figure 5.19 (c) and (e)]. Hence, this symbolic spatial image of the three room arrangement seems to be another reason for the front 3 bay type's popularity in addition to its wider exposure to the open air.

In sum, although it has not been the primary choice for the 3 bedroom plans, the growing popularity of the front 3 bay type in Seoul in recent years assures that it is regarded as a more attractive solution than the front 2 bay type (see Kang et al. 1999, 344). In this sense, it can be generalised that the driving force for the front 3 bay type is 'product quality' and that for the front 2 bay type is 'higher density'. Each of these acts as a promotive force for one type but as a repressive force for the other. The choice between the two types is decided through the interaction of these two heterogeneous forces. When the weight of 'higher density' becomes greater, then the design decision tends to flow towards the front 2 bay type; but the opposite movement can occur when 'product quality' becomes a more significant factor.

In the next phase, amongst 6 designers who chose the front 3 bay type, 3 designers now choose the exposed bathroom type and the other 3 the non-exposed 2 bathroom type. As noted above, the appearance of these show a chronological split; the former appears in the early period and the later in the nineties. In general, it is probable that the designers of the early plans simply used the exposed bathroom by 'convention' without considering the advantages they can have in unit planning when its position is internalised. It was the balcony access type plan which first experimented with the non-exposure of the bathroom; in ^{the} Mapo apartment complex (1962), this new type of bathroom was first introduced probably with an intention ^{the} to avoid ^{of avoiding} the privacy and environmental problems that might be caused by the bathroom's exposure to the public balcony (see figure 5.28).

It is assumed that when this new type of bathroom was evaluated as having caused no problem, it was actively transplanted to the front 2 bay staircase access plans from the 70s – this time with an intention to reduce the front width of the unit and thus increase the housing density. Through the 80s, the practice of using the non-exposed bathroom became a single standard option and the exposed bathroom becomes completely extinct.⁶ Consequently, when the new front 3 bay type appeared in the 90s, it was not the designers concern to consider the long-ago-extinct exposed bathroom. Instead, their concern is focused on the generation of a more consumer friendly plan with a wider facade and an additional bathroom to improve 'product quality' – thus, as can be seen on the bottom right corner of figure 5.18, all the front 3 bay plans in the 90s are equipped with non-exposed bathrooms.

Moving back to the front 2 bay type in figure 5.18, there are 58 designers (77%) who choose this dominant type. They now have the same two choices the front 3 bay choosers had: installing the exposed bathroom or the non-exposed bathroom. The exposed bathroom is adopted simply by convention until the early 80s; it appears only three times and its last appearance is in 1982. All the other 55 designers adopt the non-exposed bathroom. In this case, as described above, the designers' intention is to minimise the width of the unit by removing the bathroom from the north side, thus increasing the

⁶ According to Kim and Park's data (1992), in the staircase access type plans, the first non-exposed bathroom appeared in 1975 and the last exposed bathroom appeared in 1983 in metropolitan Seoul. In the sample of this research, they appear in 1976 and in 1982 respectively. Therefore, the sample generally conforms to the global trend of the bathroom's chronological change.

housing density of the site. Therefore, the driving force for the selection of the non-exposed bathroom is 'higher density' while that of the exposed bathroom is 'convention'.

In the last phase, after choosing the non-exposed bathroom type, two more choices are awaiting: the one bathroom type and the two bathroom type. Out of 55 designers, 30 choose the former and 25 the latter and their choices are clearly divided by year periods. Until the 80s, the one bathroom type was ^{pre-}dominantly chosen but from the beginning of the 90s, conversely, the two bathroom type takes the dominant position. It can be said that those designers who select the one bathroom type are driven by the driving force, 'lower construction cost' and those who select the two bathroom type are motivated by 'product quality'.

Overviewing the whole hierarchical tree, some meaningful pattern^s can be detected. First, it is recognised that the classifying features for the staircase access type plans are mainly two things: the number of front bays and the bathroom. The former is decided by the number of spaces facing the front open side of the unit and the latter by the number of bathrooms and their exposure to the exterior. This means that the morphology of the staircase access type plan is critically decided and characterised by these two features. As will be described later, in the case of the balcony access plans, it is the spatial combination between the living room, the dining room, and the kitchen that strongly affects the morphology. Second, the most dominant final plan, which is the 'front 2 bay non-exposed 1 bathroom type' on the bottom-left, can be reached by following the most dominant types in each phase (those connected by thick black arrows). Interestingly, this design flow is guided by the driving forces, 'high density' and 'lower housing cost' that only benefit the developers, not the consumers. In contrast, following the other force, 'product quality' which benefits the consumers, one can find at the lower-right corner the 'front 3 bay non-exposed 2 bathroom type' which appeared only three times in the sample area. This unbalanced distribution of the sample plans testifies that until recently, though there is a marked turn in the 90s towards 'product quality', the apartment housing market in Seoul has been controlled more actively by the suppliers.

5.4 Analysis of the balcony access type plans

The same graph-theoretic method, which was used for the analysis of the staircase access plans, is applied to the balcony access type three-bed plans. In this case, the 57 sample plans in Gangnam-gu area fell into 16 graph types – on average, 3.56 plans per graph. Compared to the staircase access type plans where 75 sample plans were represented by 43 graphs – 1.74 plans per graph – this result already suggests a possibility that the morphological vocabulary of the balcony access type apartment houses is much smaller. Amongst the 16 graphs, the four most dominant plan graphs are shown in figure 5.20 with the related plans on the top. Below each graph are the numbers which show how many real plans fall into it. For example, in the case of graph (a), it covers 16 sample plans, of which 4 plans are from the 70s, 12 from the 80s, and none from the 90s. The percentage inside the graph more clearly shows the dominance of the graph; out of the whole sample, 28.1% have the same topological relation of rooms this graph represents.

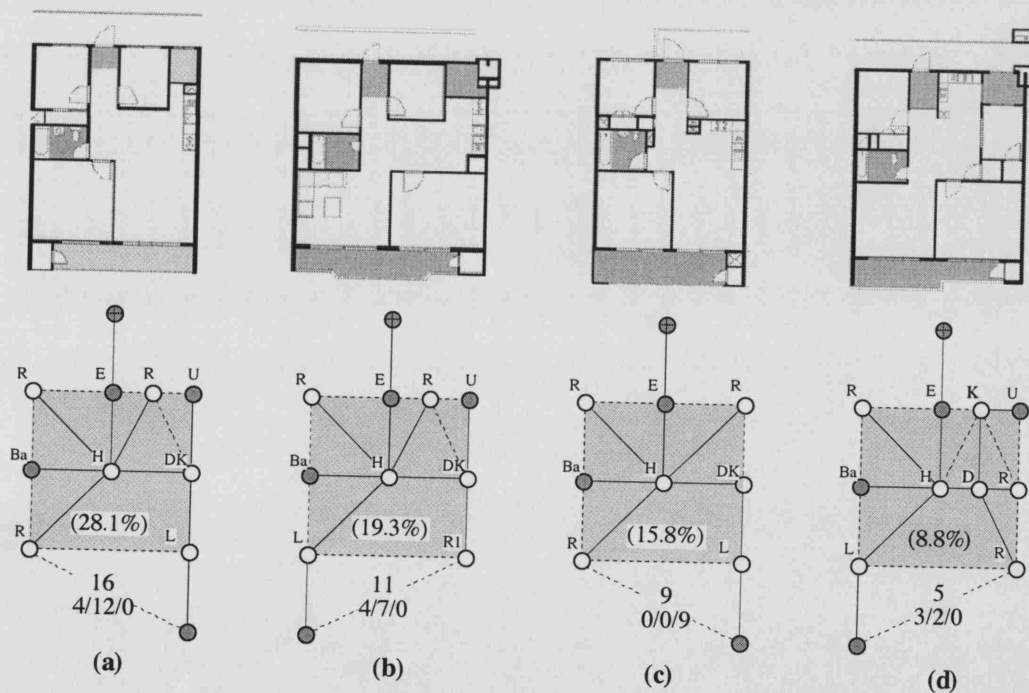


Figure 5.20 The four most frequently used graphs and the related real plans ⁷ (the sunken floored spaces are marked dark for clear distinction between rooms)

In their study, Kim and Park, from the analysis of almost all apartments built between 1962 and 1990 in metropolitan Seoul, found out that only a small number of plans are

⁷ As a standardisation process, all the plans are rotated or flipped in such a way that the entrance comes on top and the bathroom on the left in order to prevent the confusion between handed versions. Therefore all the plans that have the same topology necessarily fall into a single graph.

adopted 'constantly and ubiquitously' (Kim and Park, 1992). With respect to the three-bed balcony access plans, from the private and public sectors, they suggested three dominant types (figure 5.21).

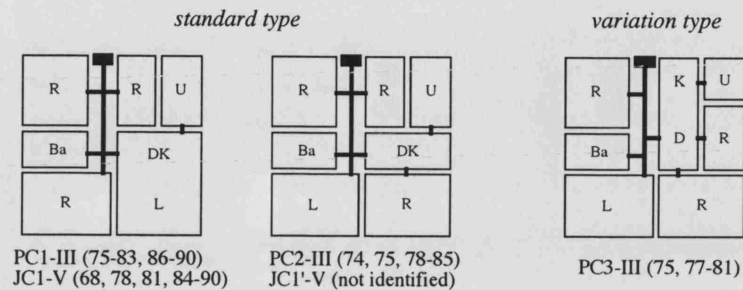


Figure 5.21 Typical balcony access type three bedroom plans in Seoul - 1962 to 1990 (reproduced from Kim and Park, 1992. Below each plan are the years it appeared)

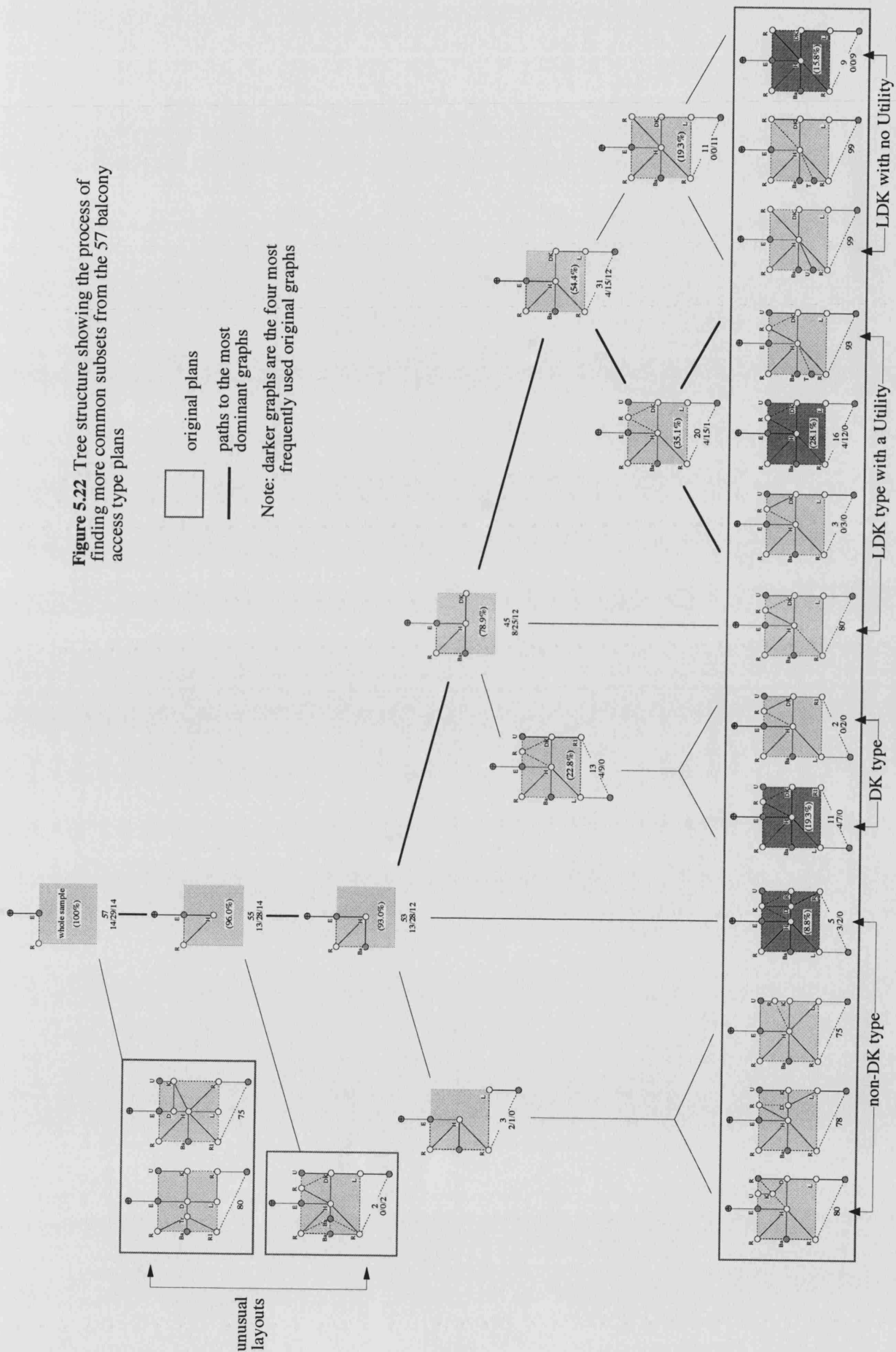
The labels under each plan are from the author's sorting method; the first letter P and J stand for the private and public sector respectively, and the second letter C stands for the balcony access type. The years below the plans show in which year they were built. By merely relying on these years of construction, it can be assumed that PC1-III has been more consistently used than the others in both private and public sectors. When these three are compared with the graphs in figure 5.20, it is found that they exactly match with the graphs, (a), (b), and (d). In addition, the dominance of the plans represented by the percentages in figure 5.20 seems to be parallel with the years of appearance in this figure. To a certain degree, it can be said, the Gangnam-gu sample well reflects the general trend of Seoul in terms of the distribution of the plan types.

The only graph in figure 5.21 that has no match in figure 5.20 is the graph (c); this is because its appearance is entirely concentrated in the 90s, the period not included in the Kim and Park's research. What is noteworthy about this 90's new plan is that it has no utility room unlike the others.

5.4.1 Finding the shared morphology in the sample

The sample plans were converted to the standardised graph format. Next, with these original plan graphs, a mathematical effort was made to seek the co-present sub-groups, i.e., the common denominators embedded within the graphs. Whereas the reduction of

the whole 57 plans to 16 graphs already confirms the existence of a strong bias towards certain plan types, the shared sub-sets within them would reveal to what degree they are closely connected. In a successive application of this process, the original graphs gradually lose their information but, at the expense of that, more global sub-patterns emerge (figure 5.22). At the end of the process, there remains one final sub-set on top which is the element universally pertinent to all the sample graphs. Not surprisingly, the overall volume of the tree structure that has been constructed through this process is smaller in scale compared to the one made from the staircase access type plans (see figure 5.7).



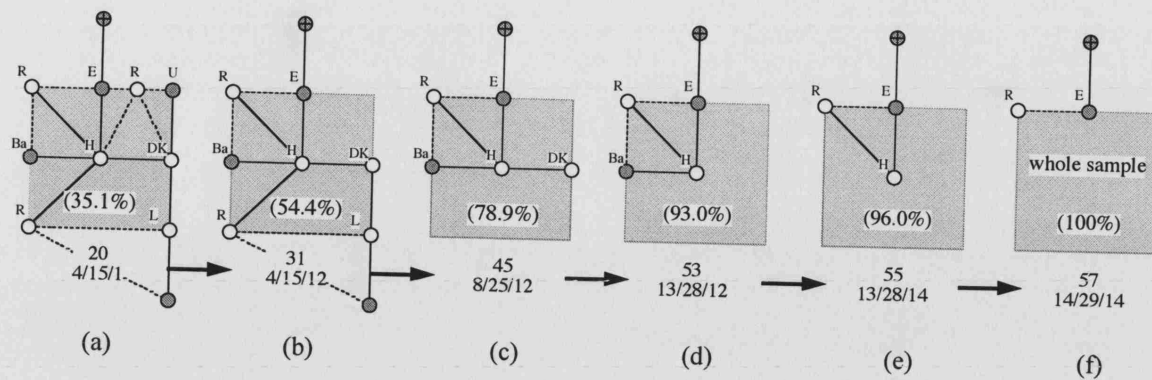


Figure 5.23 Successive generation of more inclusive sub-graphs

In Figure 5.23 are the six most dominant sub-graphs; they lie on the thicker line route which indicates a vertical order of the most influential sub-sets. Graph (a) is the most dominant in the first phase of the sub-graph generation. While it still preserves all the information of major room arrangement, its morphology is shared by 20 plans (35.1%). By losing the information on the upper right corner, now the graph (b) includes 54.4% of the sample plans. Based on this graph, by manipulating the arrangement of a bedroom and a utility room in that corner, more than half the balcony access 3 bedroom plans in the sample are created. In the third graph (c), the percentage increases by 24.5% by removing the link with the main bedroom and the living room. As the tree structure verifies, this implies that a quarter of the sample plans added in this phase have the same structure as graph (b) except that the positions of the main bedroom and the living room are switched. When the plans-per-period counter under graphs (c) is compared with that of graph (b), it is clear that these added plans are from the 70s and 80s, not from the 90s. This suggests a possibility that the planning strategy of whether the living room or the main bedroom is adjacent to the dining-kitchen could be the critical point in the development of the balcony access type unit. This issue will be illuminated in depth later.

Next, in graph (d), the removal of the dining-kitchen can include 8 more plans and this sub-graph becomes 93% universal. It should be noticed, from the counter under the graph, that these 8 newly included plans appear more in the earlier period and never in the 90s. From figure 5.22, it can be confirmed that all the 90s graphs have DK in the middle-right position. It can be said that, the positioning of the dining room and the kitchen was more flexible in the earlier time, and after going through the experimental period, it has completely settled in that position. Graph (d) absorbs 55 plans; with only

two exceptions, a great majority of plans have the central hall as a focal point in their morphology. At the end of the bottom-up process is the most common sub-graph that is embedded in every unit plan in the sample, which is graph (e). All the three bedroom plans in Gangnam-gu are entered through the entrance hall which is in the middle of the communal balcony side, and there is always one of the three bedrooms adjacent to it also facing the balcony.

5.4.2 Deterministic characteristics in morphology

Recurring generation of the sub-graphs in the tree structure was simply the process of finding the most widespread design pattern between the members of the sample group. In this method, any sub-set created always preserves the topological relations; all elements, i.e., the lines and nodes, should be linked in one way or another to make a single entity. This shows what types of partial topology are strongly embedded in the sample. In this section, as was the case previously for the staircase access plans, the focus will be on the statistical position of each room. To this end, the access and adjacency relations are now disregarded, and only each room's accumulative location is marked on a graph (figure 5.24).

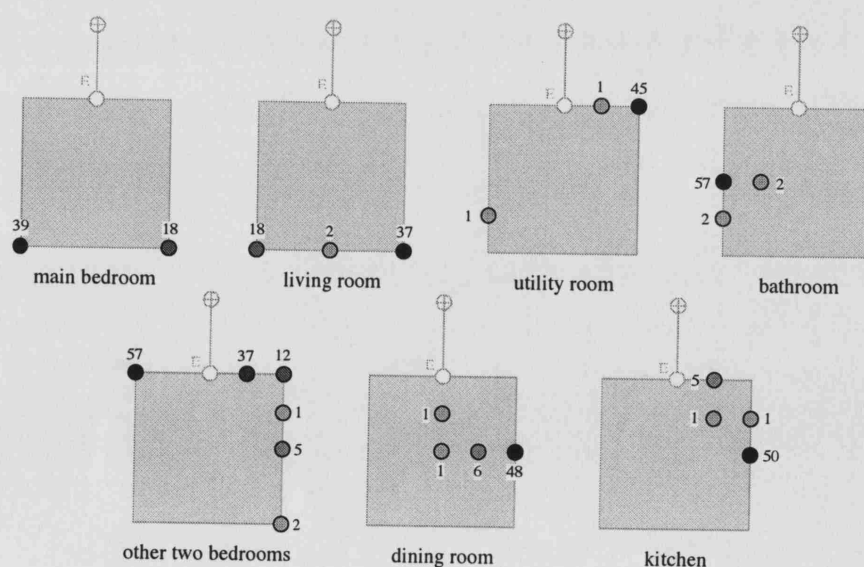


Figure 5.24 Statistical position of each functional space (numbers indicate how many times each spot was used)

In the first row, the two graphs on the left verify that the open front side is almost completely occupied by the main bedroom and the living room. Other than these two, the only room that has been ever planned on this “best” side – though only twice – is one of the other two bedrooms. While one is completely fixed in the upper-left corner, the other is relatively free in terms of position reaching from the top to the bottom of the graph. When this bedroom is not directly facing the exterior, as in the case of the dots marked 1 and 5, it is always coupled with a utility room, that is adjacent to the access balcony, through which the natural light comes in, though not enough. Meanwhile, the bathroom, one of the few domestic spaces that does not need natural light, is positioned in the middle-left with ^{out}no exception (all 57 cases), and the second bathroom that emerged in the 90s is placed near-by.

The position of the dining room and the kitchen is distributed in one particular part of the graph – the upper-right section. Since the kitchen needs to be associated with the utility room and the dining room, it would have been impossible to place it on the upper-left section because this section, which always includes the bathroom, is too small to fulfil the complex requirements of the room. Sometimes grouped together and sometimes separated, the kitchen and the dining room have significantly influenced the plan layout and thus can be the most effective measure to classify the plan types. In what follows, how the interactions of these spaces, coupled with the movement of the living room, have influenced the evolution of the plan morphology in Seoul will be investigated.

5.4.3 Transformation of the kitchen

The kitchen is the key space through which changing trends in the balcony-access type unit can be best illuminated. In the traditional Korean house, it was an isolated earthen-floored space and, compared to the raised-floored living space that was maintained extremely clean, was treated as a dirty space where one has to wear shoes. When the first apartment housing scheme was constructed in Seoul in 1962, though the traditional way of heating is substituted by a briquette boiler, the kitchen was still planned as a secluded sunken level space [figure 5.25 (a)].

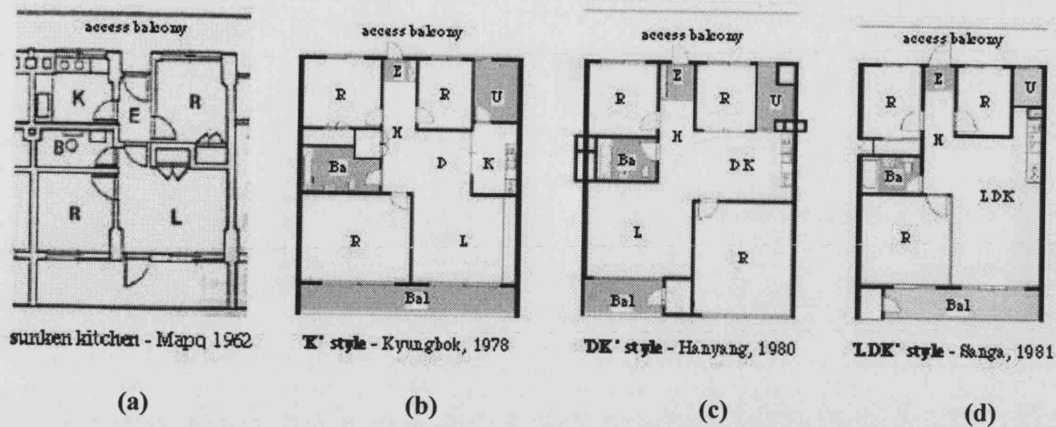


Figure 5.25 Four phases of kitchen transformation
 [(a) is a two bedroom plan but included to represent the first scheme]

In the early period, especially in the 70s, even after its floor was raised to the level of other living spaces, there was still a tendency to segregate the kitchen by a partition [figure 5.25(b)]. From the 80s on, in most of the plans, the kitchen became integrated with the dining room and, in some plans, the living room began to be merged with them in a single convex space [figure 5.25(c) and (d)].

In our Gangnam-gu sample, 5 cases belong to the 'independent kitchen' style and 18 cases to the 'integrated dining-kitchen' style, and 34 cases to the 'dining-kitchen plus living room' style – labelled as 'K', 'DK', and 'LDK' style respectively. To find out and chronicle the trend behind this change, all 57 sample plans are plotted on a graph with reference to their construction year and the kitchen styles (figure 5.26).

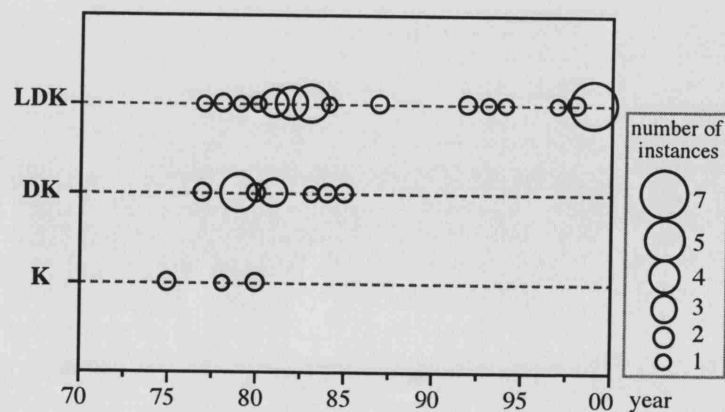


Figure 5.26 Correlation between the construction year and the kitchen style

In the graph, the 'K' style never appears after 1980; note that the first three bedroom balcony access plan built in 1975 was this independent kitchen style. From the late 70s to the mid 80s, both the 'DK' style and the 'LDK' style frequently appear. In this period, however, when their numbers of instances – equivalent to the size of the bubbles – is considered, the later is becoming prevalent as time passes. From the 90s, it is visually clear, that only LDK style plans exist in the graph. By and large, it can be generalised that there certainly is a trend that the kitchen space evolves from 'K' to 'DK' and then finally to 'LDK' as has been pointed out in the previous section.

Concerning this gradual progress, there could be many possible explanations: technical improvements of the kitchen to render itself clean enough to be displayed; a change in the status of women, which demanded that they were not isolated in a separate cooking space; the influence of the modern architectural trend towards an open plan, etc. It is probable that all of these could have acted as driving forces, but there is another dimension which is said to be an inherent characteristic of Korean dwellers. As described previously to explain the consumers' preference for the front 3 bay plan in the staircase access plan, previous research points out that people express a strong preference for a large open interior space in the apartment house as a replacement of the central courtyard in the traditional house (e.g. see Kang et al., 1999. pp. 342-346). Just like the staircase access type, the balcony access type also reflects the intervention of this trend in its evolution process.

The changing process of the kitchen found from the sample plans, coupled with the general argument of Kang et al., verifies that there is a promotive force for a more spacious public domain within the apartment house. In sum, it is certain that one influential motivation for the housing evolution in Seoul is to create a bigger public zone that creates a more spacious feeling.

5.4.4 Design intuition reflected in plan morphology

Now, the tree structure for the balcony access type is converted into a hierarchical classification diagram. Figure 5.27 is derived from figure 5.22 by translating the morphological information of the graphs into classifying types. Like the previous one for

the staircase access plans, this diagram could be neatly converted from the original tree structure without conflict.

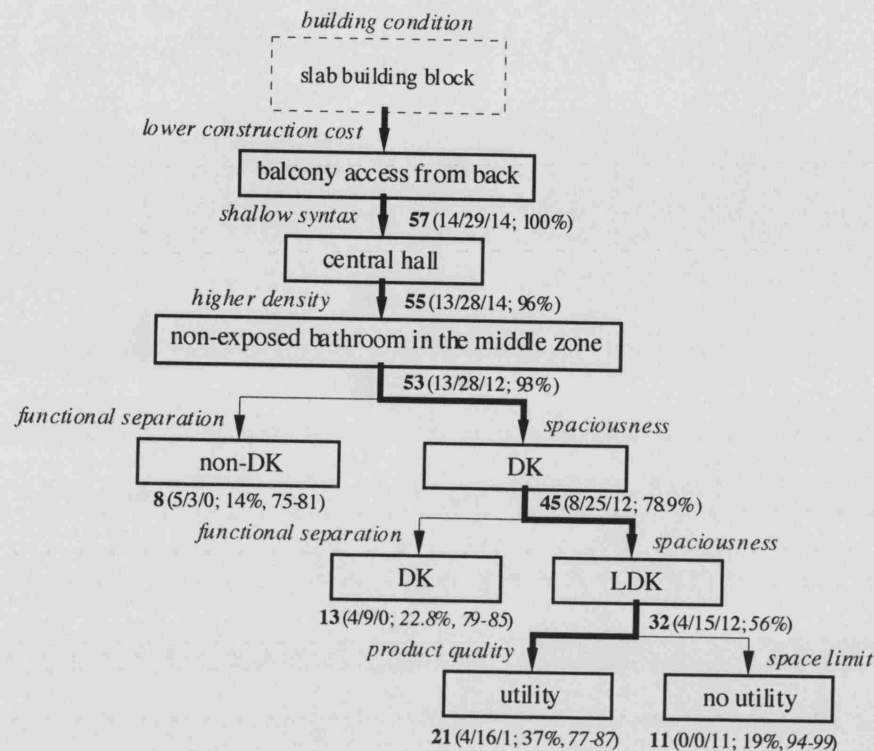


Figure 5.27 A hierarchical classification of the balcony access type plans derived from the tree in figure 5.22

[Note: 21(4/16/1; 37%, 77-87) means 21 plans, consisting 37% of the sample, appeared 4, 16, 1 times in the 70s, 80s, and 90s respectively and the first case appeared in 1977 and the last in 1987; the italic letters above each box indicates the promotive force that attracts the design decision flow; thick black arrows follow the most dominant types]

As in the previous diagram, the design flow starts from the top with 57 designers. In the beginning, they are given a building condition; a flat slab block in which each unit has two open sides. As the designers chose the balcony access pattern for building circulation, subsequently, the entrance hall's position is placed on the public balcony side. As fully described in chapter 3, in the 70s, the balcony access type was used more often than the staircase access type because it can lower the construction cost by reducing the quantity of elevators and staircases. In other words, in the earlier period of apartment construction, 'lower construction cost' was a more valued factor than 'product quality'. The popularity of this type, however, declined during the 80s and 90s as the issue of privacy received more attention.

Next, a majority of 55 designers (96%) decided to put a central hall in the middle of the house and connect it directly from the entrance hall in order to make the whole domestic configuration shallow. Thus the driving force for this choice can be defined as 'shallow syntax'.

In the next phase, 53 designers (93%) put a single bathroom in one side of the middle zone adjacent to the party wall. Looking at the tree structure in figure 5.22, it is found that, in fact, all the 57 plans use the same spot for the bathroom including the four non-standard type plans in the upper-left corner; this can be also verified by looking at figure 5.24 in which the statistical position of the bathroom is shown. Some of them have a second bathroom but its position is still adjacent to the first. This means that for the balcony access type plans in the sample, the exposed bathroom has never been used. Surveying other plans outside our sample area, it is found that the exposed bathroom has been rarely used even in the early 60s. In figure 5.28 are three plans from Mapo apartment scheme, the first scheme in the country built in 1962. Although they were planned on the same site at the same time, each of them has a different type of bathroom.

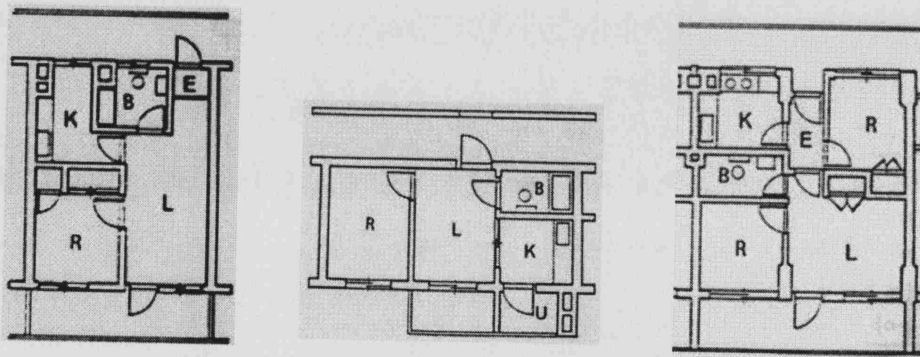


Figure 5.28 Three balcony access type plans from Mapo apartment scheme (1962)

In the left plan, it is seen that the bathroom is exposed to the public access balcony. The plan in the middle also has a bathroom adjacent to the public balcony but, strangely, it has no window – thus non-exposed. It is highly probable that this inconsistency in design is due to the designers' lack of confidence about the bathroom's exposure to the public area since it might cause a privacy problem for inhabitants and an environmental problem for passers-by. As the non-exposed bathroom had never been tested in housing before, these plans must have been regarded as experimental cases.

In the plan on the right, they pushed the bathroom to the inner side of the unit. When this plan is compared with the first plan on the left, which has the same front 2 bay structure, the major difference between the two lies in the number of bedrooms; the plan on the right has a second bedroom. In order to add the second bedroom to the access balcony side, it seems that the designers had to make a choice between two solutions: increasing the width of the unit, or moving the bathroom away from that crowded side to maintain the 2 bays' width. Since increasing the width would entail a lower site density for the whole complex, they seem to have decided to move away the bathroom that has a lower priority to be placed on the open side than the other rooms.

It is found from the tree structure in figure 5.22 that all the 57 three bedroom plans are the front 2 bay type with non-exposed bathrooms in the middle zone of the unit. Therefore, it can be said that 'high-density' has acted as a strong motivation for the utilisation of the non-exposed bathroom. Although it is also possible that the bathroom's adjacency to the access balcony would bring up a privacy problem, this seems to have been a secondary reason for its disappearance from that side. Then, the reason why it disappeared so quickly in the balcony access type – while, in the staircase access plans, it sometimes appears as late as the early 80s – can be attributed to the smaller size of the plan in general. As noted in chapter 3, as the floor area of the balcony access plan is smaller than the staircase access plan, the size of the bathroom, which of necessity cannot contract below the required minimum, would create a bigger effect in the width increase when inserted on the public balcony side.

After making a decision for the bathroom's position, 53 designers now start to consider two choices: combining a dining room and a kitchen as a single space (DK) or separating the kitchen as an independent space (D+K or K). A dominant number of 45 designers (79%) chose the DK type and only 8 designers (14%) chose the non-DK type. Interestingly, when the plans-per-year counter is checked, it is found that the non-DK type only appears in the early period from 1975 to 1981, while the DK type prevails more as time passes. The driving force towards the non-DK type is 'functional separation' and that of the DK type is a preference for 'spaciousness'. As discussed previously, the latter could be due to the modern trend owing to the improved environment in the kitchen, but the traditional preference for a big central open space like the courtyard could equally well be the main reason for this.

Next, amongst the 45 designers who chose the DK type, 13 (23%) choose that the space is separated from the living room and 32 (56%) combine them all together to make a big LDK type of space. The same contrasted forces guide these decisions; 'functional separation' for the DK type and 'spaciousness' for the LDK type. Once again, it is evident from their appearance in each period, that the former loses its popularity through time and thus in the 90s only the LDK type is selected.

In the last phase, including the utility room in the unit becomes a remaining choice. So far, without exception, all the designers who did not choose the LDK type included the utility room as a service space to support the kitchen. Some of the LDK type choosers (11 out of 32 designers), however, get rid of this service space from the plan, while more designers (the remaining 21 designers) stick to the typical practice of installing a utility room. Surprisingly, it is found from the hierarchical classification diagram that these non-utility plans all appear in the 90s. Inspecting these new 90s' plans, it is found that they have much smaller floor areas compared to the other plans; they are smaller than 60m² in net area. This corroborates the argument of other studies that more smaller sized units, which previously were 2LDK, are included in the 3LDK group in the 90s (Kang et al. 1999, 373-374). Since the reduced construction cost of adopting the balcony access pattern can be returned as a greater percentage to the smaller plans, of which the market price is lower, the designers strategically started to develop smaller balcony access plans, while giving up the bigger plans, in the 90s. First, they must have tried to shrink the plan size while preserving the existing plan morphology. As this turned out to be unrealisable, it seems they removed the utility room from the more crowded north public balcony side.

Overviewing the whole structure of the hierarchical classification diagram, an interesting pattern emerges. In the diagram, design decisions are made at six different levels. At the first three levels from the top, the promotive forces that facilitate the design decisions are: 'lower construction cost', 'shallow syntax', and 'higher density'. Apart from 'shallow syntax', the other two factors are those that benefit the developers. As the design decision flow goes down to the remaining three levels, a reversed trend is recognised. In this lower part of the diagram, the promotive forces that lie on the dominant route are 'spaciousness' and 'product quality' that match to the consumers' need. Therefore, it can be said that the morphology of the balcony access type plan is

decided, at the higher levels, for the benefit of the developers and, at the lower levels, for that of the consumers.

Interestingly, it is found that the staircase access type shows a completely reversed pattern. From figure 5.18, it is evident that the decisions at the first three levels are the results of the promotive forces, 'product quality', 'shallow syntax' and 'symbolism' that are closely related to the consumers' good or preference. At the remaining three levels, conversely, the design decisions lying on the dominant route are driven by the promotive forces, 'higher density' and 'lower construction cost' that benefit the developers. In the case of the staircase access type, therefore, its plan morphology is decided, at the higher levels, for the benefit of the consumers and, at the lower levels, for that of the developers.

At the initial stage of apartment housing design, a selection of the staircase access type over the balcony access type already implies that the designers decided to strengthen the product quality by sacrificing the economical aspect of the construction (refer to chapter 3 for details). Because of this, the design motivations for the staircase type at the higher levels tend to become those that are favourable to the consumers. For the same reason, it is likely that the higher-level design motivations for the balcony type would be favourable to the developers.

The design decisions at the lower levels, on the other hand, show a different tendency. This can be illuminated by comparing morphological variations of the two types that appear in the lower part of the hierarchical diagrams. Whereas the morphological variations of the balcony access type are generated mainly from the internal permutation of the three spaces, namely LDK, that of the staircase type is generated from bigger scale alterations such as 'adding an extra bathroom' and 'increasing the number of front bays of the unit'. This implies that, while the designers simply modified the interior layout of the balcony access type plan without changing the basic structure of it, they put more efforts to develop ^{into developing} alternative plans for the staircase access type.

The argument above can be made clearer by investigating the tree structure of each access type in figure^S 5.7 and 5.22. Amongst 57 balcony access plans, 53 plans (93%) follow 'the most typical format' that is defined as having a single bathroom in a front 2 -

bays structure and not having 'unusual layouts'.⁸ Compared to this, only 30 out of 75 staircase access plans (40%) follow the most typical format. Put simply, most of the balcony access plans follow a standardised design solution, while less than a half the staircase access plans follow it. This clear division can be explained as a result of the decreasing market share of the former and the increasing market share of the latter. Since the staircase type has functional advantages over the balcony type as mentioned before, its market share has grown along with the consumers' increasing preference. The developers and designers responded to this market trend by actively developing alternative plans for the staircase type while safely reproducing the typical plans for the balcony type with minor changes.

Hence, it is found from the investigation that although the hierarchical classification diagram shows that the balcony access type reflects well the consumers' changing needs at the lower level of design, it is done in a limited fashion. By simply re-arranging the room layout of a typical unit format, the developers seem to have tried to avoid development cost and the risk of failure in the market, and this can be interpreted as a strategic reaction to the decreasing market demand for this access type. Therefore, it can be concluded that, in a broad sense, the hierarchical classification diagram of the balcony access type supports the argument in section 5.3.5 that the apartment housing market in Seoul has been controlled more actively by the suppliers than by the consumers.

5.5 Synthesis and conclusion

Following all the arguments in this chapter, the design principles of the apartment houses in Seoul can be summarised as: (1) [^]Few dominant morphologies, (2) Shallow syntactic pattern, (3) The central hall as a circulation core, and (4) Deterministic characteristics in room position. Now, ^αthe design process can be hypothesised based on these principles (figure 5.29).

⁸ 'Unusual layouts' are those that have rare types of syntactic configurations or room arrangements and thus do not follow common layout patterns. Because these plans share only a few of the common features with the others, they are naturally placed on the upper side of the tree structure (see the boxed original plans on the upper-left corner in figure 5.7 and 5.22). Amongst 75 staircase access plans, there are 10 front three bays plans, 28 two bathroom plans, and 11 plans with unusual layouts, but, amongst 57 balcony access plans, there are only 2 front three bays plans, 2 two bathroom plans, and 3 plans with unusual layouts.

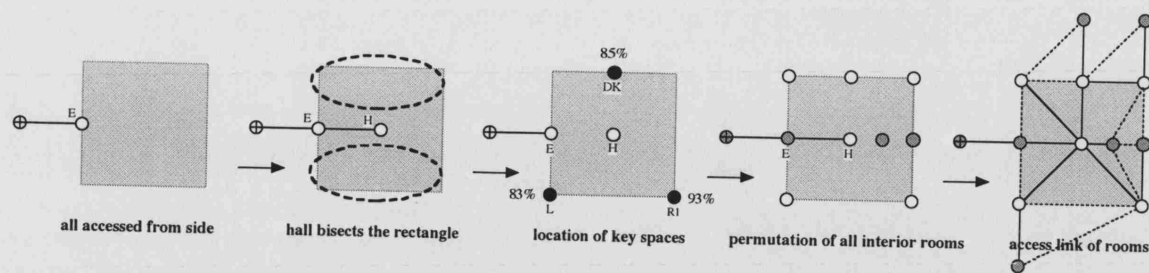


Figure 5.29 A hypothetical design process for the apartment houses in Seoul

First, the designers are given a building condition which is a flat slab block. For building circulation, then, they choose between the staircase access type and the balcony access type. Once the position of the entrance hall is determined by the access pattern, the hall is extended from it bisecting the domestic field and then the arrangement of necessary rooms takes place. The two most important rooms, i.e., the main bedroom and the living room, are almost always placed in the front to face the south. Next, the other rooms are given suitable positions with reference to their requirements and the planning strategy, but their positional variation is limited to a small number of dominant patterns. At the end, the central hall links all the spaces around in a shallowest possible way. In the sample, 96% of the balcony access plans and 97% of the staircase access plans exactly follow this design approach.

In this design process, the hall lies at the focal point of the whole unit-planning process. By bisecting the interior domain in the middle, it effectively limits the possible layout patterns to a minimum and enables the major spaces to be directly linked to make a shallow configuration. In addition, it is highly probable that this design pattern has been derived from the colonial house; the two-row layout pattern in which the central hall distributes the circulation flow in the middle was first suggested by the planners of this earliest modern detached house and seems to have strongly influenced the following house plans including the apartment houses.

In sum, the unit plans in Seoul are directed towards a shallow syntactic structure where most of the main living spaces are just 'one step away' from the hall, and this is deliberately done from the initial stage of the design by the existence of the central hall. The morphological analysis in this chapter clearly shows that all the sample plans – 75 staircase access type plans and 57 balcony access type plans – could be generated by a

simple but strong design logic and it is the traditional spatial intuition that has influenced, both consciously and unconsciously, its formulation and gradual change through time.

Chapter 6

Discussion and conclusion

6.1 Revisiting the research questions

6.2 Culture as a driving force for housing evolution: revisiting chapter 4

6.3 Culture as a determining factor for housing design: revisiting chapter 5

6.4 Conclusion: final evaluation and discussion

6.1 Overview: revisiting the research questions

This thesis has examined the changing housing culture in Seoul with a question: *how do old spatial values interact with a new domestic setting?* Efforts have been made to answer this question; using the case of the house transformation process that happened in twentieth century Seoul, three different approaches were made to illuminate the interaction between the old and the new. These three approaches were categorised as a spatial dimension, a symbolic dimension, and a formal dimension, and each dimension has examined the question in the perspective of the space-activity relation, the level distinction, and the form-syntax interaction respectively. Space syntax theory has been chosen as the best channel through which the evolutionary process of change can be analytically and objectively measured and then interpreted.

For the efficiency of investigation, the main research question was divided into three sub-questions each of which focuses on one of the three dimensions mentioned above. They are: first, *how is an old spatial organisation mapped onto a new setting that is formally and functionally different?*; second, *how is an old conceptual dimension in space transferred through a transformation process?*; third, *how is the spatial intuition from the past accommodated within the formal constraints of modern housing?*

The first and second sub-questions were tackled in chapter 4. In the chapter, diachronic analysis was made by tracking the historical development of housing types and this included the three important types of houses that existed in the twentieth century, namely the traditional courtyard house, the public sector detached house, and the apartment house. The problem of mapping the two radically different physical settings of the houses was solved by replacing the basic unit of mapping from a partitioned space, i.e. a room, to the compositional element of a room, i.e. an activity. From this conceptual replacement, the evolutionary process of housing culture could be more precisely measured. In addition, from the traces of activities, it was found that the symbolic dimension of level-distinction has guided the whole process of evolution.

The third sub-question was tackled in chapter 5. In the chapter, amongst the three housing types examined in chapter 4, only the last type, i.e. the apartment house, was put into focus. All the morphological variations of the apartment house in the sample area in

Seoul were collected and analysed. The sample plans were built in three decades from the 70s to the 90s, so these plans could show the changing process of a type in the short term as well as the formal variations in one generation. A new type of graph representation was suggested for the systematic analysis of the sample plans and it was found that there exists an archetypal tendency in the design process.

6.2 Culture as a driving force for housing evolution: revisiting chapter 4

In chapter 4, to answer the first sub-question, it was suggested that the old and new houses should not be compared by a room-to-room mapping; instead, these two heterogeneous settings should be seen through the space-activity interaction to understand the transformation process. Since, for the houses in Seoul, the rooms in the old house are not equivalent to those in the new, each room as a spatial unit in domestic space was intentionally decomposed to become its compositional elements, i.e. activities, which characterise the function of a room.

In fact, this translation of the physical structure of the house to the non-physical domestic behaviours could be regarded as the actual mechanism in the human mind that facilitates the re-adaptation to a new dwelling environment. Even in a case where the new environment is similar to the old one, people often re-arrange their domestic activities in order to make them fit better to the new setting. For instance, if the bedroom of a new home is much smaller than the one in the old house, it may not be possible to use the tea table and chairs in it as before, and hence the old habit of having tea in the bedroom has to be transferred to another room. In this sense, adaptation to a new space requires re-assignment of activities and this happens more intensely when the spatial condition radically changes.

Using the space syntax methodology, the movement of these activities could be measured in terms of topological values (RRA). The topological paths they followed through the transformation process of housing showed dynamic movements. When the new housing type emerged, some activities that belonged together in a room were separated into different rooms, while some converged into the same locality from separated rooms.

When the spatial structure of the traditional courtyard house in Seoul was renovated by the new design of the modern house in the middle of the twentieth century, most of the domestic activities had to become involved in this relocation process. This process was performed in two phases; first, by the modern designers and second, by the new users of the house. Rooms were first reprogrammed by the designers with an intention to redistribute the enclosed activities. By changing the function of each room, they tried to regulate a new way of living. In the second phase, when people moved in, they must have tried to 'read' or 'retrieve' from what the designers set up, an appropriate spatial structure for proper modern living.

The re-adaptation in this second phase, however, does not necessarily follow the designers' intention. Consciously or unconsciously, some people slightly modified the intended use of the rooms by adding to or subtracting from each partitioned space some activities, while others radically modified the rooms by completely changing their functions. It can be said that these mismatches between the designers and users were mainly due to the different perspectives on the old spatial values. The first generation of the modern designers in Seoul after the Korean War tried to change their architectural competence to fit to the new spatial language, but most of the users' minds were still living in the traditional domestic environment.

This discrepancy in the idea of the new home can be exemplified from the fact that in many modern homes people still called what designers labelled as a main bedroom by the traditional name, *anbang*. This verifies that people were still using the room in the same way they did in the traditional spatial setting; thus the activities of family gathering and having meals were still occurring in the room. In an extreme case, people actively modified the physical structure of their houses; in some of the early apartment houses, designers intentionally raised the bathroom floor up to the level of the adjacent living room to follow the western standard, but later the users had the floor rebuilt to make it lower as mentioned at the end of chapter 4. In this case, what the designers failed to notice is the indigenous symbolism which is stronger than the evolutionary power. They disregarded the fact that activities are symbolically characterised by the two contrasted domestic environments, i.e. the raised floor area and the earthen floor area.

Since the raised floor side of the house acquired symbolic meaning as a clean divine zone in the long process of evolution, activities performed in it were treated differently from those belonging to the other side. Thus the activity of body washing, which used to be performed in the courtyard or kitchen in the traditional house, was a part of the activity group defined by the symbolic nature of the earthen floor area where dirty and wet jobs were allowed. During the modern housing development, the designers could not see this inherent symbolism of level distinction, and could not even expect that it is strong enough to make the inhabitants 'act' to reconstruct their houses. The inhabitants' need was simply to perform the activity of body washing 'in the old sense' in the new space of the bathroom and therefore they wanted the floor of the room to be lowered.

Within this line of thought, the main focus in chapter 4 was to find out whether the level distinction has affected the evolution process of housing in Seoul. What caused this assumption were the two contrasted locations of the lower level spaces in the traditional courtyard house and the apartment house. In the former, the lower level spaces were all connected in one syntactic link and they were, by and large, occupying the central positions in the house; in the latter, in contrast, they were all scattered like small islands around the perimeter of the apartment house. This totally reversed status of the lower-level spaces brought the question: is the reversal generated from a gradual transformation or by a radical renovation?

From the justified graph analysis, it was recognised that there was a gradual movement of the low-level spaces from the centre towards the edge as houses evolve from the urban traditional house to the detached house, and then to the several phases of apartment plans – this visual observation was again corroborated by space syntax values.

It is highly probable that one impetus in this transformation is the idea of 'movement optimisation' in the designers' minds. Although movement efficiency is not the only factor in housing design, it seems that at least it must have been a tricky subject to think about especially for the first generation of modern housing designers. When the old central courtyard disappeared in the modern house plans, its role as a central space to link all the low-level activities together was also lost. As a result, the topological dynamics between the high and low-level spaces had to be re-defined.

Ideally, as far as the floor levels are concerned, the inhabitants' movement in domestic space can be optimised when each of those two heterogeneous space groups is linked in one cluster to allow a continuous trip within the group without wearing or removing shoes. In the earliest staircase type apartment house plan, the designer's effort to realise this movement optimisation could be recognised from the unusual design where all the low-level spaces but the front balcony are grouped in one cluster (see the third j-graph in figure 4.12 and the first plan in figure 4.13). Although this plan has meaning as an early attempt to re-arrange the high and low level spaces within the modern housing structure, its configuration was not successful since in order to separate the two different levels, it was necessary to sacrifice other living conditions.

Therefore, the following sequence of plan transformation can be characterised as a process where all the variables including the level-distinction are involved to find the optimum solution that suits the modern dwellers in Seoul. What was found in this process is a trend in which the high-level spaces are converging together in one cluster in the centre of the plan while the lower-level spaces are moving outwards towards the surrounding edges. Looking at the whole process beginning from the traditional urban house, it can be said that this was a topological movement where the two heterogeneous spaces are heading to two opposite directions, thus swapping their original positions. In this sense, even though the transformation process of housing culture in Seoul looks radical and disconnected on the surface, it can be said that there was a hidden symbolic dimension in space, i.e. level distinction, that actively guided the course. Hence, the evolution process had a direction in a Lamarckian sense and it is the old spatial values that guided the whole process.

6.3 Culture as a determining factor for housing design: revisiting chapter 5

Whereas chapter 4 covered various housing types that emerged in the twentieth century to investigate the changing process between them, chapter 5 focused on a single housing type, the apartment house. Dealing with the houses built between the 70s and 90s, what was intended was to know the underlying logic or rather compositional rules these plans might have in common. In addition, there was a more essential objective, which is to find out whether the rules, if any, could be culturally linked to the old spatial values.

Many previous studies pointed out that there are only a small number of archetypal plans repeatedly built in the city, but none of them has shown a systematic approach from which two issues, first, how this design pattern has been formulated and, second, to what degree it is replicated, can be properly examined. Aiming to overcome these limits, this thesis suggested a new graph theoretic representation by which all the sample plans could be converted to a standardised rectangular graph format containing both topological and partially geometric information.

Using the graphs acquired from the 132 unit plans, a mathematical attempt was made to find common denominators and this enabled the construction of a graph tree where the original graphs were placed at the bottom and the most common sub-graph on the top. From the direct observation of this tree structure, it was possible to reveal that what types of morphological elements are embedded in what percentage of plans. Coupled with this, further analyses revealed the fact that the unit is typically designed, first, by putting the long central hall in the middle to bisect the interior and, second, by linking major living spaces in the shallowest possible way from the central hall in terms of syntax. It was then suggested that the origin of these two prominent design patterns could be linked back to the two precedents: to the colonial house for its central hall and to the traditional courtyard house for its shallow spatial structure.

Another interesting trend in the plan morphology was that major living spaces tend to be positioned in the same spots. The most prominent one is the main bedroom of ^{whose} the position is almost always fixed in the farthest south corner from the entrance of the unit – 93% of the staircase type sample plans follow this pattern. This again verified the fact that the main bedroom in the modern apartment house still carries the old spatial values of anbang as a most important room in the house. Although its traditional meaning as a central place for the whole family has been diluted in the modern period, its symbolic significance seems to be still alive. Thus, there is a strong tendency in Seoul that the farthest south corner, which is regarded as the deepest and most pleasant in the unit, is reserved for this room.

Following the morphological analyses, an effort was made to reveal the design intuition in the process of unit plan design. What was found interesting is that the structure of the

graph tree reflects the tendency of 'design decision flow' in a statistical way. In addition, since the graphs in the tree are arranged and grouped by their morphological commonalities, it was found that the sub-graph in each branching out point could represent a particular type of plan, different from others at the same level of the tree. Therefore, the whole structure of the graph tree could be translated to become a hierarchical classification of plans (see figure 5.18 and 5.27) that helps us to read the designer's intuition.

The percentages marked on plan types are important indexes which indicate the design trend in Seoul. From them, it could be found that while the design of the staircase type plan has been affected by the factors that serve to the developer's benefit, the balcony type plan has been influenced by those that serve to the consumer's satisfaction. These two contrasted trends were then interpreted as a reaction to the decreasing popularity and market share of the latter type plan.

The morphological characteristics analysed in this thesis are based on the three bedroom plans. Since the apartment housing is the most dominant type in Seoul and three bedroom plans are the majority, it can be justified that the analysis can portray the housing culture in Seoul in general. However, it is also worth knowing how influential this design tendency is to other types. Some questions arise: are those traits in the 3 bedroom topology still applicable to the 4, 5 bedroom topologies?; do the changed topologies entail different design approaches or design logic? It is assumed if different types of apartment plans are composed by means of the same architectural approach suggested here, the argument of this study can be expanded to a larger portion of the housing stock in Seoul and thus can obtain increased objectivity.

Figure 6.1 shows the five representative plans from each bedroom type and their corresponding graph representations.¹ They are the most widely used plans in Metropolitan Seoul between 1962 and 1990 according to Kim and Park's study (Kim and Park 1992c, 76). Pointing out that in Seoul a small number of typical plans were repeatedly produced, they ^{made} put an interesting comment on the relation between the size of

¹ The one bedroom type is not included since no single popular plan could be identified from any research. It seems that many different plans have been tested in the market but, since the demand was not high, no dominant one bedroom plan could be developed. Moreover, the one bedroom type is typically planned without some of the essential living spaces like living room, or dining room and thus its morphological structure is not directly comparable with the other types.

the unit and design variation. They argued that when the area of the unit increases, it simply causes an increase in the size of each room or an increase in the number of rooms, “failing to create unique unit plans for the area” (Kim and Park 1992a, 3). The last phrase, in quotation marks, suggests that the plans in Seoul are designed in the same manner regardless of their sizes – though Kim and Park did not provide a technical analysis on it.

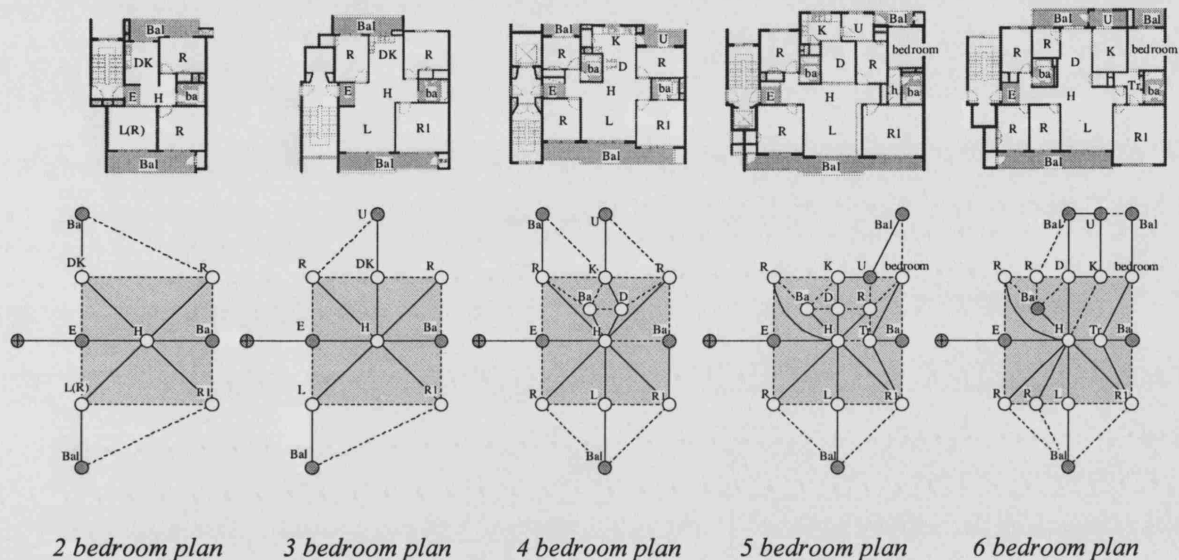


Figure 6.1 the most popular staircase type plans in metropolitan Seoul between 1962-1990

In figure 6.1, moving from the left to the right, it is obvious that the spatial system is getting more complex as the number of rooms increases. Both from the plans and the graphs, however, it can be recognised that all of them possess some features in common; they all show the typical design patterns of the three bedroom sample plans. First, they all put the central hall in the middle so that the plans can be divided into two; second, the hall directly links the major living spaces to make the system as shallow as possible.

In addition, the positions of rooms also show the same deterministic characteristics of the three bedroom plan. The main bedroom is located in the farthest south corner from the entrance and the living room tends to come between the main bedroom and another south facing bedroom, making the R1-L-R adjacency link that is arguably derived from the traditional R1-maru-R access link. As the system gets bigger, the dining room and the kitchen tend to be separated, but their positions still remain in the central zone of the

upper half of the plan so as to be best connected to the living room in the south. Therefore, when the morphological condition allows, there exists a strong tendency in which the overall design patterns conspire to let the bedrooms surround the public rooms, namely LDK.

In his book, *Architectural Morphology* (1983), Steadman suggests, after Bon's research, that close packing of rooms tends towards a hexagonal shape to maximise the potential connection between rooms [figure 6.2(a)]. In the diagram, if the rectangle in the middle is taken as a hall, six connections can be made from it. Interestingly, the 2 bedroom plan in figure 6.1, which is the most compact plan, has a comparable layout in which the hall has six access links to other surrounding spaces.

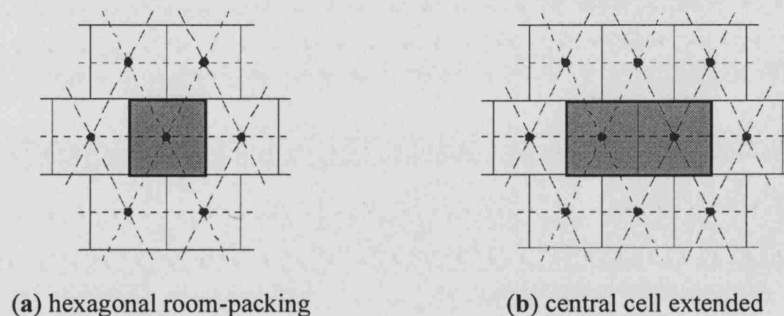


Figure 6.2 Hexagonal packing of rooms and the most prevalent plans in Seoul
[reproduced from Steadman, 1991, p.402]

Now, if this central cell of the hexagonal diagram is elongated, it can have contact with more surrounding cells as in figure 6.2(b). Similarly, in the plans in figure 6.1, as the number of rooms increases, the hall gets longer to be able to gain more connection to them, and as a result it becomes more like a corridor. Thus, it is the one penetrating principle in planning the staircase type plans that all the small and big units are generated by following this morphology. Put simply, in this type of grammar, the system grows by multiplying the cells lying on the perimeter of the extending axis of the central hall.

In the case of the balcony type plans, there are not many bedroom types since it has been used mainly for smaller units as fully discussed in chapter 3. In figure 6.3 are the most popular balcony access type plans identified by Kim and Park in the same study. These plans also share the same design principle as in the staircase type: the central hall in the middle linking the major living spaces together for the shallowest space structure. Unlike

the staircase access type plans, however, these plans do not show a clear morphological pattern that governs the growth of the system.

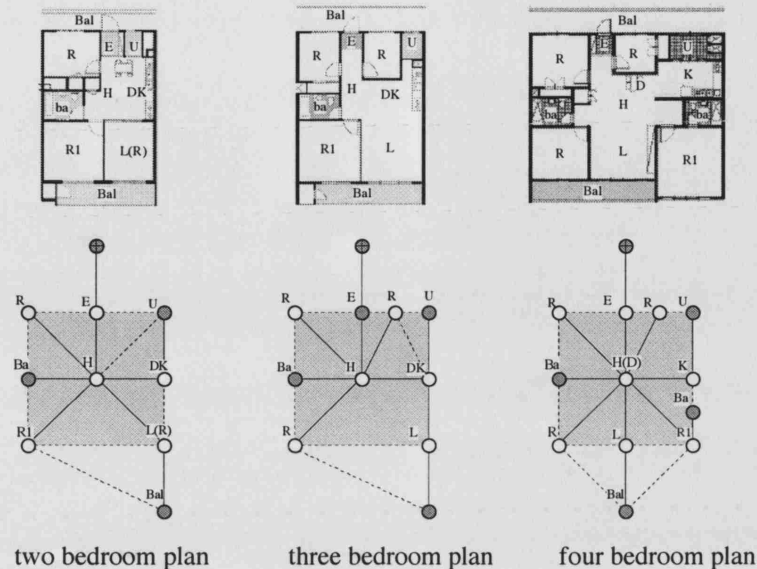


Figure 6.3 The most popular balcony type plans in metropolitan Seoul between 1962-1990

Because habitable spaces need to be exposed to the exterior for natural lighting and fresh air, unit plans of both balcony access type and staircase type necessarily have limits in growing merely in the direction of the front-rear axis. In contrast, as far as these environmental requirements are concerned, they have no limit in growing in a sideways direction. In the case of the staircase type, this side direction coincides with the axis of the central hall, and therefore, plans with a bigger area can be easily generated as seen in figure 6.1. In the case of the balcony type, as the direction of growth does not lie on the axis of the hall which extends from the north entrance towards the south, the plans with more bedrooms are generated in a somewhat complex pattern. For instance, the four bedroom plan in figure 6.3 has a central hall space where its original front-to-rear axis and the new side-to-side axis intersect each other. Therefore, it seems that this ineffectiveness of the balcony access type in generating an easy and clear morphological grammar is another reason for the designers' preference for the staircase access type.

6.4 Conclusion: final evaluation and discussion

So far, the housing culture in Seoul has been investigated in three categories of dimension: a spatial dimension, a symbolic dimension, and a formal dimension.

From the perspective of a spatial dimension, it has been found that no matter how the function of each room has changed in a new house, the fundamental activities remain the same – they are only redistributed into different locations in the new setting. In other words, even though new activities emerge and old ones ^{disappear} demise, by and large, the basic activities are not lost during the housing evolution – they are simply travelling around in time within the domestic field! Therefore, through the space-activity interaction, it was revealed that what could be intentionally changed is the physical setting of the house, not the culturally specific activities.

From the perspective of a symbolic dimension, it has been confirmed that the old symbolism not only persists through the turbulent time of change but even guides the process of change. This hundred years old symbolism, although it cannot be defined as a single activity or event, has been crystallised at the level of unconsciousness in people's minds. Without being noticed, it had been transmitted from generation to generation and, in the time of change, it implicitly affected the intuition of the designers and dwellers who had to face a new housing culture. In this second part of the analysis, the symbolic concept of level distinction, of which no proper research has been ever executed, was illuminated in the light of the space syntax theory.

From the perspective of a formal dimension, the modern housing culture in Seoul was intensively explored. Surprisingly, the design process which was performed within the purely modern design setting was strongly influenced by the thoughts that originated from the old design concept. Although at first it looks as if the plans skilfully synthesised the two recent design motifs, i.e. the rectangular unit format of the modern building and the two-row room arrangement from the colonial house, their configuration has been formulated from the traditional thoughts about domestic space.

The results of these three analyses strongly suggested that, even in a fast changing society, the new house is not completely disconnected from the heritage of the old house.

In a sense, their existences are only separate at the physical or rather material level not at the behavioural and spatial level – thus old spatial values do persist!

There have been many studies dealing with the housing culture in Korea. Some^{have} argued that the tradition has been disconnected in the twentieth century and others tried to argue that the apartment house successfully replaced the tradition of the old courtyard house. What is lacking in the former argument is the role of space in evaluating the architectural tradition; they only see the tradition from the surface value in a typological sense and thus, to them, modern buildings are not counted as a part of the tradition. If tradition is seen only from the phenotypical standpoint, however, the consistency of tradition can always be broken by a new style at any time. What is lacking in the latter argument, on the other hand, is the analytical power; even though they adopted the concept of space instead of outer features, they purposefully tried to match each space of the old and new houses to show the transmission of tradition. For instance, it has been argued that the living room in the apartment house is the functional substitute for the courtyard in the traditional house because the former succeeds the role of the latter as a central hub for the movement flow. As verified in this thesis, it is a naïve thinking that modern rooms can find their matches in the old house; rooms are continually reinvented with its changing activities as the house evolves.

Rapoport (1976, 1990) suggested that the broad concept of ‘culture’ can be dismantled by investigating its lowest level of components, activities, in association with their architectural settings (refer to chapter 2 for details). While he only portrayed the abstract outline of this conceptual frame without presenting the possible methodology for research, this thesis has formulated a model in chapter 4 in which the cultural mechanism between the space and activity could be actually measured and evaluated in the light of the space syntax theory. As a room cannot be defined by its label or its representative function, this space-activity model has been an effective tool to precisely measure the changing process of housing in time. Moreover, this model has made it possible to tackle the issue of level distinction which has been regarded as being too abstract to deal with.

Coupled with the diachronic analysis above which covers a century of time, another effort has been made in chapter 5 to find out the modern design pattern using the new^{uncover/clarify} graph theoretic method. Dealing with the three decades of this period, the analysis^{a?}

exhibited both a synchronic snapshot of one generation and also a diachronic trial-and-error process of a style within the short yet turbulent time of change. The findings in this part of the analysis, then, could be linked back to the first analysis in chapter 4 to corroborate the heritage of the genotypical spatial values in Seoul.

The argument of this thesis has been established, therefore, on an analytical basis with a view to systematically revealing the relationship between culture and housing. By adopting the new approaches in utilising the graphs and mathematical values, it tried to avoid vague and ambiguous descriptions in interpreting the morphological characteristics of houses.

While this study tried to cover the century's changing process in housing, there are some limits to its methodology and argument. As there appeared a single dominant type of housing, apartment housing, in the later part of the twentieth century, the housing culture in this period had to be represented by it and consequently its possible design interaction with other types, e.g. multi-family housing and detached houses, could not be put into focus. Although these other types of housing show a decreasing degree of importance in terms of their proportion of the housing stock, it would be meaningful to examine how the old spatial values have interacted with different types of domestic spaces. It is hoped to be the future work to combine the study of these other types with the findings of this thesis to illuminate alternative paths of the spatial values. Finally, at the end, an expectation is made that the argument of this thesis, which has been established on a data analysis, could lead to productive suggestions for the housing industry in the future through the synthesis with relevant ethnographic studies.

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